THE AMERICAN GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 32 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXX. No. 6
Whole No. 1,235.

NEW YORK, MONDAY, FEBRUARY 6, 1899.

$3 PER ANNUM,
IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

LIBRARY OF CONGRESS
FEB 7 1899
404560
SMITHSONIAN DEPOSIT

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICES—
- February Meeting, Society of Gas Lighting 181
- Twenty-eighth Annual Meeting of the New England Association of Gas Engineers 181
- Sixth Annual Meeting, Michigan Gas Association 181
- First Annual Meeting, The Kansas Gas, Water and Electric Light Association 181
- Change of Meeting Time, Western Gas Association 181
- Wrinkle Department, Western Gas Association 182

EDITORIALS—
- Briefly Told 182
  The Association Meetings for February—Notes.
- A Southern Rosin Gas Plant, by Mr. F. H. Shelton 182
- Automatic Gas Meters and Cookers 183
- *An Example of Electrolysis of Water Mains in Brooklyn, N. Y. 183
- Systems of Meter (Electric) Rates, by Mr. E. L. Debell 184
- Coal in North Dakota 186
- Address of the President (Mr. F. Z. Schellenberg) at the Last Annual Meeting of the Central Mining Institute of Western Pennsylvania 187
- The Analysis of Mantles for Incandescent Gas Burners 188
- High-Speed Engines, by Mr. J. H. Dales 189
- Debate on Two Questions Asked at the Last Meeting of the Northwestern Electrical Association 190

ITEMS OF INTEREST FROM VARIOUS LOCALITIES 191
The Macon (Ga.) Company again in the Hands of Its Owners—Proposed Gas Works for Litchfield, Conn.—Annual Meeting, Middletown, Ohio—Extending the Scope of the Boston Licensing Act Respecting Gasfitters' Licenses—Annual Meeting, Yonkers, N. Y.—Consolidation at Charleston, S. C.—Cheaper Gas for Williamsport, Pa.—Progress on the Gas Works for Torrington, Conn.—Death of Mr. A. H. Smith—The Passaic and Bergen County (N. J.) Gas Company—Annual Meeting, Clyde, N.Y.—Annual Meeting, East Boston, Mass.—Something about the Change at Pittston, Pa.—Annual Meeting, Hoosick Falls, N. Y.—The Westinghouse Company Ships Gas Engines to England—Contract for the Berlin Iron Bridge Company—Annual Meeting, Butte, Mont.—And Other Items.

- A Mammoth Refrigerator 193
- The Market for Gas Securities 193

[OFFICIAL NOTICE.]

February Meeting, Society of Gas Lighting.

OFFICE OF THE SECRETARY, Feb. 1, 1899.

The February meeting of the Society of Gas Lighting will be held in "The Arena," No. 39 West 31st street, New York city, at 3 P.M., of the 9th inst.

FRED. S. BENSON, Secretary.

[OFFICIAL NOTICE.]

Twenty-eighth Annual Meeting of the New England Association of Gas Engineers.

OFFICE OF THE SECRETARY, LYNN, MASS., Jan. 16, 1899.

To the Members of the New England Association of Gas Engineers:

The twenty-eighth annual meeting of the New England Association of Gas Engineers will be held at Young's Hotel, Boston, on *Thursday* and *Friday*, February 16th and 17th, 1899.

The matters for discussion will be announced later. Members are requested to send to the Secretary questions for the Question Box, and are especially urged to contribute to the meeting short papers on any subject pertaining to the business.

The Secretary will send blank applications for membership to those desiring them.

Carefully note the change of date from the usual Wednesday and Thursday to Thursday and Friday.

CHARLES F. PRICHARD, Secretary.

[OFFICIAL NOTICE.]

Sixth Annual Meeting, Michigan Gas Association.

OFFICE OF THE SECRETARY,
SAGINAW, MICH., Jan. 31, 1899.

To the Members of the Michigan Gas Association: Gentlemen—The Sixth Annual Meeting of the Michigan Gas Association will be held in Lansing, on Wednesday, the 22d, and Thursday, the 23d, of February, next. The headquarters of the Association will be at the Hotel Downey, the rates at which hotel are from $2 to $4 per day. Papers for presentation will be:

"A Desirable Increase and its Source," by Mr. S. E. Wolf.

"The Importance of Proper Boiler Settings in Water Gas Plants," by Mr. John R. Lynn.

"How we Obtain our Patrons," by Mr. A. L. Zwisler.

Contributions will also be made by Mr. B. O. Tippy and Mr. T. B. Guitteau.

Respectfully, HENRY H. HYDE, Secretary.

[OFFICIAL NOTICE.]

First Annual Meeting, The Kansas Gas, Water and Electric Light Association.

OFFICE OF THE SECRETARY,
LEAVENWORTH, KAS., Jan. 27, 1899.

To the Members of the Kansas Gas, Water and Electric Light Association: The first regular meeting of this Association will be held in Topeka, Kas., on Wednesday, the 15th, and Thursday, the 16th of February. Members of our Association, and all who may desire to attend our meeting, will kindly govern themselves accordingly.

Yours truly, J. H. FOLEY, Secretary.

[OFFICIAL NOTICE.]

Change of Meeting Time, Western Gas Association.

WESTERN GAS ASSOCIATION, OFFICE OF THE SECRETARY,
NEW ALBANY, IND., Jan. 10, 1899.

To the Members of the Western Gas Association:

On account of the inclement and disagreeable weather usually prevailing in Milwaukee during the month of May, the Board of Directors, acting upon the advice of the Entertainment and Executive Committees, have unanimously voted (with the exception of Mr. Littleton, who is in Europe), to change the date of the next annual meeting of the Western Gas Association, from May 17, 18 and 19, to June 14, 15 and 16.

Members of our Association, and all who may desire to attend our next annual meeting, will govern themselves accordingly.

JAMES W. DUNBAR, Secretary.

[Official Notice.]

Wrinkle Department, Western Gas Association.

Western Gas Association, Office of the Secretary,
New Albany, Ind., Jan. 16, 1899.

To the Members of the Western Gas Association :

Mr. E. H. Jenkins, Editor of the Wrinkle Department, desires it known that those who have contributions to offer for publication in this valuable division of the Association's proceedings, should forward the same at as early a date as possible. All matter of this nature should be in hand not later than April 1st. Let no member fail to mail Mr. Jenkins a description of any device that saves labor or insures through its use better service in the production or distribution of gas.

Address all communications to Mr. E. H. Jenkins, Engineer Buffalo City Gas Company, Buffalo, N. Y. J. W. Dunbar, Secretary.

BRIEFLY TOLD.

The Association Meetings for February.—Our list of official notices shows that the second month of the year is to be a busy one in the instance of stated meetings of the fraternity for the purpose of free discussion as to the best methods and means of improving the standing of the industry. The first in order is the Society of Gas Lighting, whose meeting is named for the 9th inst., in this city, and its work on that occasion it may be taken for granted will be of the high order that always marks its sessions. Next on the list is a newcomer, the Kansas Gas, Water and Electric Light Association, whose members will meet in first annual session in Topeka, Kansas, the third Wednesday and Thursday of this month. The organization meeting of the Association was held some months ago. Mr. L. T. Palmer, of Leavenworth, is its President, and Mr. J. H. Foley, of the same city, is its Secretary and Treasurer. We understand it has a membership of 30, that they are enthusiastic in their work for the success of the Association, and that —although its objects are threefold, as its name implies—the leading object of its work will be the advancement of the gas interest. Next in sequence is the 28th annual assembling of the pioneer of them all, the New England Association of Gas Engineers, who will meet in Young's, in Boston, on Thursday and Friday of next week. We hoped to have been able to print in this issue the complete programme of the sessions, but delay in connection with the settling of a detail or two precludes. Enough is known, however, to make it certain that the meeting will be brimful of interest, both from a technical and social point of view. A feature of the outing time will be a visit to the new coke oven plant at Everett. The last of the February meetings is that of the Michigan Gas Association, whose sixth annual convention will be brought off in Lansing on the 22d and 23d of the month. Secretary Hyde's detailed programme appears in our current issue, and it shows that the Wolverine gas men, rather than slacking in their efforts are increasing them. This list of meetings should, in fact must, prove to every gas man that his craft and art are very much alive.

Notes.—Heretofore we announced that the engineering partnership between Mr. Isaac C. Baxter and Mr. Jas. T. Lynn, of Detroit, Mich., had been dissolved by mutual consent. We are now enabled to state that such dissolution does not mean the retirement of either gentleman from active business. In the rearrangement Mr. Baxter has associated with him, under the firm name of Baxter & Young, Mr. Peter Young, formerly Engineer of the Halifax (N. S.) Heat and Fuel Company, and at present Engineer and Constructor to the Peoples Gas Light and Coke Company, of Buffalo, N.Y. The plant of the last named Company was erected entirely under Mr. Young's supervision, and although we do not think that Buffalo needed another gas plant, it is nevertheless true that the Peoples plant there is a splendid example of modern gas works construction. Mr. Young has had large experience in the management of artificial and fuel gas plants at different points in America, and has also had much to do with coke oven construction and operation. As for Baxter—well everybody in the gas business knows his capacity and merit. That they may have the fullest measure of success is our honest wish.——The minutes of the testimony taken at the inquest held by Coroner Zucca, in relation to the loss of life caused by the failing of a holder on the plant of the Consolidated Gas Company, this city, have not yet been translated into long hand.——The proprietors of the White Plains (N. Y.) Lighting Company have announced a new rate schedule. Under it consumers are to be charged $1.80 per 1,000 cubic feet gross, prompt payment (within 10 days) to entitle the user to a rebate of 10 cents per 1,000.——The Peoples Gas Light and Coke Company reports $113,037 as due the city of Chicago, on account of the 3½ per cent. tax on gross receipts from sales of gas for the last quarter of 1898. For the corresponding quarter in 1897 the sum amounted to $111,557.

[Prepared for the Journal.]

A Southern Rosin Gas Plant.

By Mr. F. H. Shelton.

I have for years heard of "rosin gas" as made here and there, more especially in small towns in the South, but never, until a few weeks ago, have I happened to be able to see a plant for making it. As there are no doubt others situated as I was and similarly ignorant of just what a rosin gas plant consists, as well as of any figures upon its cost, the following notes are offered for the convenience of any such who may be interested.

The term rosin is merely indicative of the material from which the gas is made. The gas itself is substantially an ordinary illuminating gas, made for and distributed as such. The use of rosin for this purpose in small gas works in a certain section of the country is the natural result of the fact that it is comparatively cheap and plentiful, and that it is easily distilled in small retorts into a passably good gas. Rosin itself is the residue which is left after distilling turpentine with water, and the rosin used for gas making is the ordinary amber-colored, hard, brittle, barrelled rosin of commerce.

The plant visited is located at, and supplies light to, the Western Home for the Insane, a large State institution in Staunton, Va. A low, one-story brick structure, duly whitewashed and shaded by delightful old trees in true southern style, houses it, while near by are two small gasholders of 6,800 and 10,000 cubic feet capacity respectively. The entrance to this gas house is the most constricted that I have ever seen. A small, clanging, resonant iron door, perhaps 20 by 40 inches, is unbolted, revealing a black hole of the nature of a coal chute into which the visitor is invited to enter. Boldness is repaid, however; for after a descent of a few steps an interior is revealed that is really attractive from the atmosphere of age, individuality and difference from anything with which one is familiar. In the center are two small brick benches, queer and old. The nameplate reveals the date of 1850, and, together with the crudeness of the finish of the binding straps and bars—suggesting a country blacksmith's work—well proves, if such additional evidence were needed, the old-fashionedness so-to-speak of the construction.

Above, the roof is pitch black with the accumulated smoke of years; to the right is a pile of rough, odorous pine wood in cord sticks, used for firing, while to the left is a shattered barrel of glistening, really beautiful, iridescent rosin awaiting the stoker's charge. Most striking and unique, however, are the two large iron, open-top kettles of the perfect, picturesque gipsy pattern, set in the brickwork on top of either bench. The kettles are unquestionably the most distinctive feature of rosin gas apparatus. In them the lump rosin is thrown, when gas making is started. The benches meanwhile are fired beneath with the cordwood, and in due time the heat produced is sufficient to heat the kettles—imbedded in the setting as they are—and melt the rosin within. In the bottom of each kettle, projecting like taps from a keg, are two elongated discharge outlets, controlled by valves, and these latter are so adjusted that a stream of the melted rosin of about the size of a straw is allowed to flow from each, into square funnels leading into the external ends of the respective retorts directly underneath. These retorts are two to a bench, side by side, are of cast iron, D-shaped, and measure about 7 or 8 feet long by perhaps 10 inches wide by 7 inches high, inside. They are filled inside with broken limestone to catch, baffle, check—call it what you please—the rosin vapor within. The melted rosin, entering as a liquid in front, in traveling the length of the retort is vaporized and distilled therein and passes out the rear as rosin gas. Four-inch take-off pipes connect the rear of the retorts with diminutive cast iron hydraulic mains or seals, one to a bench, located on the floor in the rear (and around which tar is plentiful). From these mains a 6 inch pipe leads the gas through a few lengths of pipe outside—serving as an air condenser—into the storage holders. No exhauster, scrubber or purifier, is used; nor station meter. The make is figured from the rise of the holders. These latter are fitted with water sprinkling devices to keep the crowns cool, for the reason, I was informed, that "We can get more gas into them that way."

The size of the gas house is perhaps 15 by 20 feet. The benches are about 5 feet wide, 5 high and 6 or 7 feet deep, and in general effect and operation are not widely dissimilar from small oil gas benches. They are about 3 feet apart, with a squatty stack between, as well as a short flight of steps, the latter to afford convenient access to their tops for charging rosin in the kettle.

In the Western Home in question the gas consumption is not very great, with the result that the gas plant is not run continuously, but

only as needed to keep the holders supplied. This in winter is about twice a week; in summer about three times a month. When the holders are almost empty a "run" of gas is made of about 16,000 feet, which amount refills them and takes care of the consumption in addition during the 15 hours time which is occupied in the operation. The materials used for the 16,000 feet comprise just about a cord of wood (at $2.25), and from 110 to 150 pounds of rosin (at $2.25 per barrel), which latter, however, varies from 350 to 400 pounds in weight. The limestone in the retorts is replaced each time gas is made, but its cost is trifling. One man can manage things all right, although an able bodied inmate is usually around to fire and give advice. The rate of make per hour is about 300 feet per retort, or 1,200 feet per stack of two benches of 2's. No steam is used excepting in winter to keep the holders from freezing; nor is water used, except in the hydraulic seals, drips, and on the holder crowns. The retorts last 2½ or 3 years. If gas were made more often they would, of course, burn out more frequently.

The gas made burned with a clear, soft, yellow flame, but seemed easily affected by draughts and to readily smoke, as is characteristic of most gases distilled at low heats from oils or other rich substances in small benches of this type. Its color was strong and sufficient and distinctive from that of either coal or water gas.

In the making of rosin gas an element of excitement that is liable to occur at any moment is the boiling over of the kettles. If the quality is poor and too much water is in the rosin from the original turpentine distillation, or if the fire is too hot, ebullition and foaming are very likely to ensue when the rosin is melted, and the rosin may boil up and over. Its inflammable nature is obvious, and when it does boil over and catches fire and the room is ablaze and full of dense, blinding smoke, the local excitement around the premises is said to be about second to none.

Automatic Gas Meters and Cookers.

Mr. Edward A. Harman, Managing Engineer and Secretary of the Huddersfield (England) corporation gas works, writing in *Engineering*, remarks that as a side issue to the engineering world, the rapid development of the penny-in-the-slot system, which has astonished the millions, demands something more than a passing notice. Perhaps one of the most surprising adaptations is that for gas distribution. The enormous success of this system is possibly due mainly to the reasonable desire of the public for knowing what they are buying; the cash payment; and also to the immense popularity of the pennyworth.

To such a state of perfection have automatic gas meters been brought, it is impossible to foresee to what extent they will be ultimately extended. It is probable in the near future that different rooms, workshops, offices, etc., of the same institution will control the consumption of what is required for lighting and heating purposes by automatic interception meters, rather than allow an indefinite quantity of gas to be used without regard to cost, as in many cases existing at present. Such waste not only affects the cost of production of materials, but also the health of the workers, which is of the first importance. It may be found advantageous where rooms are let as apartments in houses or hotels to allow each tenant to be responsible for his own amount of gas, in preference to the unsatisfactory fixed charges so generally made. For internal arrangements in workshops slot meters might be employed, by a mutual arrangement with the head of the department and the employees; of course, in such a case the meter would be the property of those directly concerned. The meters being fixed in a passage or landing, can easily be available for examination and collection from time to time. In cases of illness the ready check afforded upon the consumption of a bedroom stove is a satisfactory element.

Applications for automatic meters are so numerous that few gas undertakings can afford to be independent of the assistance afforded by them. It is not so much the financial side of the matter, as revenue earners, that has to be considered as the popularizing of gas in every home, office or workshop. It has recently been pointed out that for city and town offices a gas fire is, perhaps, as useful a system of heating as can well be used, no attention being required from the time the stove is lit in the morning to when it is turned off at night, thus saving not only time in this, but avoiding annoyance of too large or too small a fire and other attendant inconvenience. For bedrooms, gas fires are becoming increasingly popular. Where properly fixed and connected by a flue direct into the chimney, this method of heating is peculiarly suitable. The temperature of a room can be maintained most evenly night and day, which in severe cases of illness is of immense importance, while the necessity for making the fire up, and thereby disturbing a patient, are dispensed with. There is, moreover, the additional important consideration that the fire is always available. To those affected with asthmatical, bronchial or kindred complaints, this cannot afford to be disregarded, especially considering the liability of a sudden attack, which often occurs in the middle of the night, when some time must frequently necessarily elapse before a coal fire can be got ready. If this notice were from a medical point of view, instead of from an engineering one, much might be said upon this subject. The omission of reference to the convenience obtainable in cases of illness would, however, render any notice of gas fires incomplete.

Many gas undertakings are now recognizing the importance of giving every facility for supplying gas fires, are fixing them free of cost, and only making a nominal annual charge for the stove. The undertaking of which I have the honor to be the engineer, is doing this with good results. In consequence of what has become to be known as the "fixed free stove business," the numerous stove and meter makers have been inundated with orders, the delays occasioned in consequence being vexing alike to the consumer and the gas officials. The method of calculating the desirability of adopting this penny-in-the-slot system is most simple, My experience is that for an ordinary automatic meter for lighting purposes only, the annual gas consumption therefrom equals 10,000 cubic feet, and where a small cooker is supplied, this consumption is doubled. This quantity of gas, at the profit on cost of manufacture per thousand, will furnish the income available as interest on the small original outlay, depreciation and the extra cost of collection. From 20 to 35 cubic feet of gas for a penny is the general charge. An ordinary flat flame burner consuming 5 feet per hour will thus last from 4 to 7 hours, or where an incandescent burner is used, consuming from 3 to 4 cubic feet per hour, the time the pennyworth will last is proportionately longer. Generally speaking, gas undertakings supply fittings, burners, meter and stove free of cost, so that the consumer's maximum liability is only one penny. My experience is that the addition of a small cooking stove is as great a convenience comparatively in small class property as in large, where gas cooking stoves are considered well nigh indispensable.

Such a development is one of the branches of the great engineering profession is truly astounding.

An Example of Electrolysis of Water Mains in Brooklyn, N. Y.

Engineering News reports that, early last December, a 48-inch water main, located in the eastern part of the city of Brooklyn, N. Y., burst, doing a great amount of damage to adjacent property, and cutting off the water supply over a large area of the city. A brief description of the accident was given in *Engineering News* for December 15, in which the cause of the break was stated to be a defective casting. We have since been informed, on the authority of an engineer who examined the pipe shortly after the break occurred, that the broken section displayed unmistakable evidence of electrolytic action. The place where the break occurred is in the vicinity of an electric railway power station, and it is generally understood that ground currents from the electric railways are to be found on the water mains in many parts of Brooklyn, and were recently shown to have even crossed the Brooklyn Bridge and made themselves evident on the lower part of Manhattan Island. In self-defense, the Fire Underwriters may be forced to increase insurance rates in cities where water mains have been injured by electrolysis.

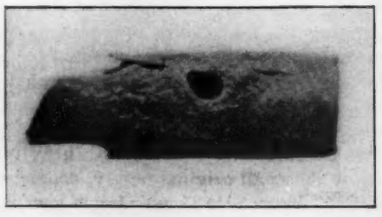
The accompanying illustration is reproduced from photographs of a section of an 8-inch water main recently taken up. It is of interest as an example of the effect of electrolysis in thinning iron pipe, and also as a piece of circumstantial evidence upon the causes of the break in the 4-foot main above referred to. The hole in the upper side was originally plugged by a brass corporation cock. The pipe was originally of fairly uniform thickness (about ½-inch) throughout its circumference, as shown by inspection of the pipe at a point 2 or 3 feet from the corroded section.

This specimen of corroded pipe was recently presented to the Executive Committee of the National Board of Fire Underwriters, together with a report upon it by the expert engineer of the Board, from which we quote as follows:

Owing to the bursting or giving way of a 4-foot water main in Brooklyn, the attention of the community of Greater New York has recently been somewhat startlingly called to the destruction that is going on underground upon the water pipe systems, and an examination made by the undersigned of a portion of the removed pipe once more gives evidence of what has been claimed would happen if the authorities did

not take necessary and proper steps. In other words, the imperfect construction of trolley roads is causing slowly, but surely, the destruction of water and gas services throughout the country.

In regard to the probable condition of the water pipes in Brooklyn and that portion of New York city immediately above and to the north of the Harlem river, the undersigned begs to state that a careful inquiry made among the employees of the Water Board in Brooklyn brought to light the fact that they (the employees) were fully aware of the conditions as they existed and do exist at the present time, as they have been knocked down by the current while working upon water mains, and, in some cases, severely injured, and in other cases badly burned. Yet in this community such a state of affairs is permitted to exist, and, as far as the records show, no effort has been made on the part of the insurance authorities to prevent it. And yet it could have been prevented, and if I may be permitted to say so, must be stopped



now or the community at large will inevitably meet with nothing less than a conflagration when the conditions for such an event happen; and when they do happen, the events will be coincident, and it may not only be a large loss of property by fire, but it may mean the loss of a great number of lives.

Let us suppose, for instance, a case which can be readily imagined. What would have happened if a fire had occurred in Brooklyn among the frame buildings in the neighborhood of the break in the 4 feet water main? This particular locality, as far as the buildings are concerned, would have been completely wiped out of existence, and lives would certainly have been lost in the general panic. This statement is not made by the undersigned for the purpose of appearing as an alarmist, but simply as an actual state of affairs as they exist to-day, only in far worse condition in other parts of Brooklyn. For instance, one of the head employees of the water works in Brooklyn made the statement to the writer that one of the railroads was absolutely using a 6 inch water main as a return feeder, and the authorities were not objecting. Admitting, if you please, that this is a fact, what would be the natural result in a short space of time? You can form your own opinion when intelligent expert engineers have proved beyond peradventure that 1.5 volts difference in potential between the water pipe and rail is dangerous; and here we have a railroad company deliberately transmitting an enormous current at a voltage anywhere from 250 to 400 between the trolley wire and the underground pipes. If they were simply transmitting a current with a difference of potential of 15 or 20 volts, enough facts have been presented to prove that this amount of voltage carries with it a current that would, of necessity, under the natural laws, cause enormous destruction. In proof of this, permit me to call your attention to another exhibit and complete report recently published by the trustees of the Dayton, Ohio, water works. I will quote from that report for your information: "At 4.5 volts it has been shown that 6-inch pipe can certainly become useless in five years." Query: What is now the condition of the 6-inch water pipes in Brooklyn, if what the employee has said is true, that a 6 inch pipe has been used as a return feeder with from 200 to 300 volts pressure upon it? Again: "It is known to the department that certain pipes have been destroyed beyond the limit of the danger district at 1,300 feet."

The natural query is: Can the destruction of these pipes be prevented, and how? It can, and there are several methods. The most absolute way of preventing the destruction of underground pipes in a large community like this (New York and Brooklyn) is to compel the overhead trolley to go underground, and use double metallic circuits, as has been done on the Metropolitan Railway lines on Manhattan Island. Admitting, for argument's sake, however, that the railway cannot, without undue expense make this change, they should at least be compelled to immediately rebond their roads and run return feeders, having a conductivity and capacity equivalent to the greatest amount of current that may be required at any one particular time during the operation of the road, and they certainly should not be permitted to humbug the authorities in the matter of bonding as they do now in the majority of cases. For instance, they should not be permitted to bond or electrically connect two sections of 70-pound rails with a No. 0000 B. & S. wire, and consider that they have done their duty in the way of providing a return path for the current; inasmuch as a single track of two rails (70 pounds) has an equivalent of 17,405,000 circular mils, whereas a No. 0000 bond wire is equal in circular mils to 212,000, a difference of 17,193,000 circular mils.

Systems of Meter (Electric) Rates.

[A paper read by MR. EDWIN L. DEBELL, before the Northwestern Electrical Association.]

The study I have been able to give this subject has greatly increased its importance in my estimation, and impels me to urgently advise all central station operators to give it more serious consideration than it has yet received. We all know that our properties are operated at a poorer rate of economy than any other class of power plants, being in effective operation only a few short hours out of each 24. Have we given due consideration to the cause of this defect; what means, if any, may be employed to remedy it, and what a surprising amount of benefit would result thereby to ourselves and our customers? I think not, and the object of this paper will be an attempt to show how these conditions are affected by the systems of rates employed.

The contract, or flat rate system, although still in quite extensive use, is neither logical nor satisfactory. In the early days of electric lighting the service was employed mainly in business places, and only the number of lights needed for regular daily use were installed; lamps were all of one size, and the station usually run only until 12 or 1 o'clock at night. Under these conditions, flat rates were fairly successful, and could not be greatly abused. The fixed charges on the property, however, were very high for each hour of operation, and high rates had to be charged.

Nowadays the use of the service is more varied. Business places require a large number of lights for display and other occasional use, and we are called on to supply current to dwelling houses, shops, churches, halls and other intermittent consumers. Lamps are supplied in sizes from 2 to 50-candle power, and most of our stations are now operated all night, if not the entire 24 hours daily. Under these changed conditions, the flat rate privileges can be, and are, grossly abused. The central station is not only compelled to supply a large quantity of current for which no pay is received, but also to invest additional money in machinery to supply it.

The justice of charging each customer for the exact quantity of current used, and the employment of suitable devices for ascertaining that quantity, cannot be questioned. The number of recording meters installed within the past few years, and the constantly increasing use of them, indicates clearly that this is generally accepted as the true basis on which to frame the charge for electric current.

This proposition being accepted as true, we now come to the main question involved in this paper. What system of rates will be most just and satisfactory to our customers, and at the same time maintain or improve our present earnings?

First, let us study prevailing methods and see if they are founded on the true cost of production. The usual custom is to charge a fixed rate per unit, with discounts proportionate to the quantity used. The rate per unit has been determined either by the present average cost of the total units produced, by estimation, or by the rates in most general use by others. In any case, the cost has been made to include all fixed expenses on the property, such as interest, taxes, insurance, management, clerical work, etc., and which generally amount to 75 per cent. or more of the total cost of each unit produced. As the great bulk of the station's output is accomplished in the three or four hours of heavy load each day, a like proportion of the fixed expenses is charged against that period. Thus, according to our own calculations, each of the remaining 20 or 21 hours has to stand but a small fraction of the fixed expenses, yet we charge our customers the same amount for each unit used in those hours as in the heavy load period. The process is one of average, and does not distribute the expense ratably to each customer.

It may perhaps be claimed that the process is fair on account of the manner in which we have to operate our stations, but it is a matter of great doubt whether this manner of operation is responsible for the present system of rates, or if the rates are responsible for the poor operation.

When we charge nearly or all of our fixed expenses against the current used during a few hours, and then assess it again on each unit used in the remaining hours, it makes the cost of the service especially burdensome, if not prohibitive, to those using it for long hours at a time. These customers are the most valuable to the central station, and should be encouraged by every possible means. We should do every-

thing we can to keep them and to secure more of them, as they keep our investment employed a longer time each day and add to our receipts, without any increase whatever in our fixed expenses, and very little in running expenses.

Let us study how a system of differential rates would affect this question. In order to apply such rates we first have to determine the total cost of production per unit, including fixed and running expenses of every kind. Next determine how much of the cost is for fixed expense and how much for running expense. If exact records of these costs have not been kept, a close enough estimate can undoubtedly be made to answer the purpose. It will be found that the running expenses form but a surprisingly small portion of the whole. This is not a supposition or guesswork, but has been proved by the records of many well conducted stations.

The report of an examining board to the authorities of Aberdeen, Scotland, in 1897, gives some very interesting arguments on this feature. They refer to the poor rate of economy of the electrical plant owned by that city, and compare it with their gas works. They show that the former has to install and hold ready for use generating machinery sufficient to meet the maximum requirements of all their customers at any given moment. That their plant had a capacity, if run 24 hours daily, the same as the gas works, sufficient to supply 3¾ millions units per year; yet in the preceding year, only 214,000 units, or less than 5¾ per cent. of the capacity of the works had been supplied. A load diagram of the station was shown, almost identical with those common to our own stations. The opinion of the board was that this unfavorable condition would be improved by a varying or differential system of rates, based on the true cost of production and giving discounts according to the value of the customer to the station, in contradistinction to the total quantity consumed.

They submitted a statement showing a comparison between their best and worst customer for the preceding year. The best was a comparatively small consumer of current, employing less than 2-horse power of the station's capacity, less than $400 of its capital, and chargeable with but $27.50 of the annual capital charges. He employed the service for 2,000 hours during the year, however, producing a revenue of $288, or about $260 over capital charges.

The other employed 177-horse power of the station's capacity, nearly $37,000 of its capital, and was chargeable with $2,582 of the annual capital charges. He used the service but 61 hours during the year, paying therefor $823, or less than one third of his portion of capital charges.

These are undoubtedly extreme cases, one showing a very large load on the station for about 12 minutes, and the other a small load for 6¾ hours per day for 300 days in the year. The system of rates recommended by the board would compel the larger customer to pay a very much higher rate, or to abandon the service and make way for customers of the other class, who would be encouraged by the lower rates the system would give them.

Mr. Arthur Wright, electrical engineer to the corporation of Brighton, England, and originator of the Wright demand indicator, gives some figures covering the ratio of fixed and running expenses in the Brighton plant, in a pamphlet published in 1896.

To show what a small portion of the total cost of production lies in running expenses, and why it follows that the output of a station can be enormously increased with only a small addition to the total expenses, he has selected and given figures on two periods of three months each, one ending July 31 and the other Dec. 31, 1895. In the first period, the cost of coal and engine stores amounted, in round figures, to $2,500, and the station supplied 110,000 units. In the other period, coal and engine stores cost $6,000, and the station sold 366,000 units. The fixed expenses were alike in each period, and with the possible omission of some unimportant items, the running expenses were increased only $3,500 to increase the output of the station 3⅓ times. The company's records show that of the total cost of operating the Brighton plant in 1895, less than one sixth part was for actual running expenses. This is the ratio, with coal at $2.50 per ton, and Mr. Wright states that at the lower cost of coal in nearby towns, it would be less than one-ninth.

To come back to the application of the differential rates. After the fixed expense has been determined, a ratable portion should be charged against each customer. A number of devices have been introduced to determine this ratable portion, further reference to which will be made later on. A sufficient rate is to be charged to cover both fixed and running expenses, until the customer has paid his share of fixed charges, after which the rate may be reduced so as to cover only the running expense incurred in supplying him with, of course, a reasonable profit added. The plan does not necessarily reduce rates, except to such customers as are found profitable at reduced rates. Those who use a large quantity of current at infrequent and irregular intervals, or whose demand is largely during the hours of the station's heavy load, would not be affected in that way, and by the use of some of the devices employed the most undesirable of such consumers would be subjected to a higher rate. The tariff may be arranged to suit varying local conditions, as in present methods.

The main object of the differential rate, and which, if accomplished, is obviously of the greatest importance to all central stations, is to induce longer hours of use for our product, and enable us to make special low rates to those who can find use for current during our slack hours. Our best customer is he who employs our capital the greatest number of hours per day, and our present rates are calculated to repulse, rather than encourage him. He now uses as little current as possible, and that usually at the time when it is most valuable to the station. The remainder of the time, when we would be making most profit, even at a lower rate of charge, he "pieces out" with other kinds of light or power.

How plain it is to us when we pass a store in the evening and see in use only a few of the electric lights installed, that our revenue from that store is but a fraction of what it used to be, while our expenses go on the same as before. We feel this still more acutely when we see our service dispensed with entirely, and who of us can say that such sights are uncommon? Observation will prove that those most inclined to give up the service are meter customers running long hours, the very ones the station can least afford to lose.

In considering the adoption of differential rates, local conditions should be studied. If little or no demand can be found for current during the station's slack hours, even at a very low rate, the success of the system would be doubtful. If, on the other hand, a large demand could be worked up, the system would be highly profitable to the station and prove satisfactory to the public. The hours of effective operation would be increased, without any increase at all in fixed expenses. So large a part of the total cost is incurred in getting ready to supply current, and so little in actually supplying it after the machinery is started, that if central stations could be operated continuously up to their capacity, they could produce current so cheaply as to render competition out of the question. Of course this is an ideal condition and will probably not be reached in the near future, if ever. It should be possible, however, to improve existing conditions to quite a large extent, and I think we should not cease our efforts until we have at least found work for our stations that will materially increase their output through prolonged hours of operation. It seems clear that only by this means can we increase our business or even hold what we now have. If we can accomplish this, even to a moderate extent, it will so decrease the cost of production per unit that each of our present customers could have more current at the same, or less, cost than now, and the remainder, even if sold at a very low rate, would bring sufficient revenue to largely increase the station's profits.

New business for our maximum load period will not accomplish this, as it entails an almost proportionate increase in fixed charges and does not extend the hours of effective operation. A system of rates giving the service, to customers who can use it outside of rush hours, at prices they can afford to pay, seems to be the most logical and feasible way. It may not appear an easy matter to find such customers, but if we first thoroughly inform ourselves how extremely low we could really afford to make the rates for a fair quantity of this class of business, the difficulty would not appear so great.

As to devices intended to carry out the plan of differential rates, they are of several forms. The Wright demand indicator, as its name implies, records the greatest amount of current used by a customer at any one time, the theory of its use being that such maximum demand on the station should regulate the portion of fixed expenses to be borne by the customer. It is assumed that the customer will use his maximum demand a certain length of time each day, coincident with the maximum station load, and for that much of the total amount consumed he should pay a rate sufficient to cover fixed and running expenses. For the balance consumed, as shown by the usual recording meter, a lower rate is charged.

The double recording, or two-rate meter of the General Electric Company, appears to be their regular type with the addition of an extra set of dials and a clock mechanism. The clock is wound half-hourly by the action of the current, and may be set so as to cause the meter to register on one set of dials all the current consumed during any predetermined period, and on the other dials at all other hours. The theory of the use of this meter is that a customer's portion of the fixed expense should depend on the total amount of current he uses

during the station's heavy load and a lower rate be charged him for all consumed at other times.

It is claimed that it enables the customer to use current liberally during all the hours of the station's light load. Although costing about $25 more than the simple recording meter, it possesses the good quality of performing the entire work without the aid of any other device. The customer can readily see how much each of high or low rate current he has used and it is adapted to use on both direct and alternating systems. It has a mild tendency to prevent a heavy load during the station's rush hours, but not in the remaining hours when heavy consumption is rather desirable than objectionable.

The Oxley multiple rate meter controller, described in *The Electrical Engineer* of Jan. 18, 1898, is a small electro magnetic switch, to be installed at each point of consumption, and to be operated by a controlling switch in the central station. It may be used in connection with two recording meters, closing the circuit in one or the other at the will of the station operator by his manipulation of the station controller, or it may be used with a single recording meter, in which case it employs resistance to retard the speed of the meter during the low-rate period. The theory of its use is the same as that of the General Electric Company's 2-rate meter, although I am informed it cannot be applied to alternating systems.

No attempt is made herein to give a technical or lengthy description of these devices. More than a brief mention of them, as means with with which to carry out the differential rate system, would be of no practical value in this place. If any of you wish to consider such a method of rates, you will want to study the various devices yourself, and decide upon their relative merits according to your local conditions.

The theory of differential rates may be applied in a modified form with the use alone of the ordinary recording meter. Mr. Thayer, of Belle Plaine, Iowa, describes a plan in *The Electrical Engineer* of Dec. 23, 1897, stating he had then been using it for about a year, and that it had been highly satisfactory in the cases to which it is adapted. He appears to have adopted it largely in order to avoid straight flat rates, and does not refer to it as a differential rate plan, yet it appears to be somewhat on the same lines.

To a customer who installs more lamps that are needed for regular everyday use he makes a fixed charge of 33 cents a month for each light used during the hours of the station's maximum load, and 5 cents besides for each kilowatt hour consumed. The 33 cents may be considered a charge for fixed expenses, incurred in getting ready to supply him with current, and the 5 cents per kilowatt hour a charge for running expenses after the machinery has started supplying him. Mr. Thayer states that this plan has proved a good one for a large class of his customers. It prevents any wide variation in the monthly bills, which is a frequent source of complaint from customers during the winter months. At the same time, the certain revenue of 33 cents per light will, in most cases, cover fixed expenses, and the 5 cents per kilowatt hour a reasonable return for the service. It does not make the charge burdensome to the customer burning long hours, the very one we should seek to get. The monthly charge for a light burned daily 2 hours would be 48 cents; 4 hours, 63 cents; 8 hours, 93 cents, and 12 hours, $1.23. Thus, a customer using lights until 9 o'clock P. M. daily throughout the year, would burn about 2 hours per day in the middle of the summer, making the cost per light 48 cents, and about 5 hours per day in the middle of the winter, costing about 70 cents, or an average the year round of a trifle less than 60 cents per month for each light.

A device such as the Wright demand indicator should be useful to stations selling current on the flat rate plan. Monthly rates could be made for each individual or class of customers, based on the greatest number of lights they would use at any one time, an additional charge to be made if that number should be exceeded.

In the case of dwelling houses, notice could be given the station when a large number of lights were to be used on special occasions, and the indicator could afterwards be reset. This would give the station knowledge of the frequency and extent that lights were used in excess of the agreed manner. It would check waste of current to a large extent, and reduce the maximum loads, especially in dwelling houses, where it is most serious, under the flat rate plan. The maximum station load would also be reduced, increasing its capacity and earning power, by making room for more customers with the same amount of machinery and coal consumption.

Any of the foregoing methods embody the differential rate theory in a greater or less degree, and should result in improved efficiency in the operation of our stations. If the system cannot be adopted in its entirety, some features of it might be applied that would meet local conditions more nearly than present methods, and work alike to the satisfaction of customers and the benefit of the central station.

To my mind, the question merits the careful study of every central station operator, and is of so much importance that if we fail to give that study voluntarily, the trend of our business will force it on us sooner or later.

Coal in North Dakota.[1]

The existence of beds of lignite coal in North Dakota has been known for some time, but the extent of these beds and their ultimate value to the people of the State are appreciated by only a few. Though the area of the coal deposit is continually being increased by new finds, there is still, doubtless, a vast extent of coal in North Dakota of which nothing certain is yet known.

It is quite probable that the coal deposits of North Dakota are of the eastern flank of the Rocky Mountain coal range, which has been followed over 500 miles north and south. Whether the outcrops discovered are fragments of one large coal basin which has been broken up and covered with later formations, or whether they are deposits of numerous woody swamps of the same geological period, we may not determine. But it will be sufficient to say that North Dakota alone has, without doubt, coal enough to supply herself and her less fortunate neighboring States for years to come.

The general direction of the coal deposits appears to be from north to south. The seams generally outcrop along the banks of streams or on the sides of a bluff leadings to the valley below. The seam commonly worked appears from 50 to 100 feet below the level of the surrounding country, and varies in thickness from 7 to 20 feet. There is, usually, over or under this coal, a layer of light-colored clay, which may, in some cases, prove to be a fair fireclay. In some localities coal may be found below the layer now worked. In any case it is not to be expected that anthracite coal will be found in North Dakota, for the geology of the country would hardly permit it. It is conceded that anthracite varieties are associated with folding and metamorphism of strata.

The coal of different localities varies somewhat in its physical as well as its chemical properties. Most samples have a general appearance between that of cannel and brown coal. In one or two cases it approaches true bituminous coal.

The deposits, for the most part, lie in the western and central portions of the State. A few miles west of Minot, Ward county, coal is found outcropping along the sides of the bluff. Indications are that the coal continues for some distance along the valley. Coal has been mined in two or three places in this locality.

Going west of Minot, coal again appears in the western part of Flannery and Buford counties. About Williston there is evidently a considerable deposit. South of Williston, about Medora, Billings county, in the Bad Lands, coal is found but is not mined, so far as is known. East of Medora, at and about Dickinson, there is a considerable amount of coal mined, especially from the large deposits of the Lehigh mine. In the banks along the valley from Sims, Morton county, to New Salem, coal is frequently seen. At Sims there are two or three places from which it has been mined. Coal occurs some distance north of Mandan, and along the Missouri river in McLean and Mercer counties there are said to be extensive beds. Near Dunseith, Rollette county, small deposits have been found on the southern slope of the Turtle mountains. A good quality of coal is found in Hettinger county.

From the localities mentioned it will be seen that the coal deposits of the State must cover a very large area.

A number of samples analyzed at the chemical laboratory of the State University gave the following average results:

Water and volatile matter	48 37
Fixed carbon	44.71
Ash	6.92
	100.00
Sulphur	0.34

The variety and the value of coal depend mainly upon the purity and the proportion of fixed carbon and volatile matter.

The ash of North Dakota coal is generally not high. It is of good color and very free from clinkers. The amount of sulphur is very small, in some cases being hardly more than a trace.

For general heating purposes the value of coal is often approximated by the amount of fixed carbon it contains. From the analysis of North Dakota coal it will be seen that the average of fixed carbon is 44 71. Analyses of several of the Iowa coals give 45.42 per cent. fixed carbon;

1. By Mr. E. J. Babcock, in *Mines and Minerals.*

of Indiana, 51.20; of Ohio, 58.10. Using this method of estimation, the heating power of a ton of North Dakota coal would be not far below that of a ton of Iowa coal, about four-fifths of a ton of Indiana coal, and about two-thirds of a ton of Ohio coal.

As compared with wood, there is no doubt that, for ordinary purposes, the coal is far superior at reasonable prices.

The value of coal varies widely according to the use to which it is to oe put. For some purposes this coal will not be good, but for general manufacture and heating purposes, in which most of the fuel is used, the coal of North Dakota is well adapted.

North Dakota coal, though lignite, is of high grade. The statistics of Germany and Austria show that many millions of tons of this fuel are annually used in those countries for domestic and other purposes.

It will probably not be long before improved methods of burning will largely increase the use of this coal. Fair tests cannot be made by burning lignite in the common anthracite or soft coal burner. Lignite should be used in a burner suited to its peculiar characteristics. It is understood that experimentation in this line has already resulted in the production of a burner which will make lignite a much more convenient and economical fuel. It can only be a matter of time when the people have become better acquainted with this coal, and the proper methods of burning, till it will be much more extensively used. Such a cheap and abundant supply or fuel will also help wonderfully in establishing various manufacturing industries.

Address of the President (Mr. F. Z. Schellenberg) at the Last Annual Meeting of the Central Mining Institute of Western Pennsylvania.

Coal was effectively in use on two glorious days of this long summer in front of Manila and off Santiago de Cuba, and we were reminded then, too, of its great part in the making of the ships, their armor and armament. We remembered that from old Spain and those hills of Cuba where our invading army landed, have come ores in years before to be smelted into some of the steel we carried; and we know it was a fleet's present only coal supply on May 1st, and then another's on July 3d, that made each of these a memorable date.

The Spaniard has lived through four centuries, bravely seeking the barbaric splendor of gold and silver, but his pride breaks at last before the enlightened power of coal and iron.

The coaling stations in the seas are the outposts of a world's commerce and civilization, and what responsibilities to our nation shall cluster about them as fortified ports, is the political question of the day.

Men born in the lands of the oak and the pine cannot wander unscathed under native palms, and our flag as the emblem of nationality of a strong race at home in the temperate zone, should never wave over weaker millions as the subjects of our servants in government, lest our people lose their own virtue, liberty and independence.

The people of the torrid zone need little of our export product, and their great export is mostly the result of forced labor we do not want to take over.

Several successive administrations of our government must have been thinking of work to do in Asia in keeping such a fleet as Dewey's in those waters all these years; and the demand for control of big and little islands thousands of miles away seems a response to the longing of our far Western States for a Pacific ocean commerce.

There is coal in plenty on the other side of the globe, and the Chinese who had not been able to handle it below 250 feet depths, have begun, under English, Russian and German direction to mine it at the north on the large scale.

The Orientals of the temperate zone are capable of great advancement, as witness the Japanese. Perhaps the railroad building some of our people are taking part in will make a better distribution of the wealth within those old civilized cooler countries, as we believe improved roads and rivers are the concomitants of truer civilization among the settled inhabitants of continents; forerunners with commerce at the shores and in the islands in expansion of equal rights among men. In China the village government is democratic to start with.

The English practice of keeping the people of sub-tropical countries in employment for trading purposes and large return to investments has been a graft not interfering with decent native laws and religions. By keeping all executive control in their own hands the British take good care that justice in the rough is better done among the crowds that would trample each other in person and property, and running also parallel schemes of philanthropy, they command acquiesence.

But Great Britain, or her competitors in imperial business, cannot do that so simply in hot countries with savage inhabitants feeling little need to labor.

The "tight little island" is safe from foreign labor's actual intrusion, but cannot keep out better or cheaper manufactures any more. We expect to hear less here about tariff for protection since we export manufactures as well as food, cotton, lumber, silver, copper, lead and iron at low prices (sometimes at less than syndicate prices at home), nor quite so much about Europe's pauper labor since the miners there have larger annual earning (besides government aid in disability and old age funds) than our coal miners have here in these States.

Out of the 200,200,000 tons of coal produced in the United States in 1897, the State of Pennsylvania mined 107 millions—52½ anthracite, and 54½ bituminous. But that moiety of anthacite rated more than twice as much in money value as this other, of which only the coking coal part sustained itself; other exceptions of the bituminous being fields where affiliation of consumer and producer prevents harmful competition of the open market.

This year again the bituminous product has been crowding the market until lately, when the buyer, dumbfounded at the lack of railroad car supply, has been manifolding his orders as previously were his sellers their offers.

The race to rattle the market and give away bituminous coal at low stages of wages, with exhaustion of the store in the ground, has been saddening, but the utter folly of devastating the coal fields in exploitation by wide work only is exasperating.

We tapped natural gas here 2,000 feet under the Pittsburg coal seam, and let it go because we were seeking petroleum, and were ignorant until too late of the despoiling of a generation's local store of fuel; but the waste of the resources becomes a crime against nature when men allow it with open eyes. Many will say a statute of the Commonwealth should name and penalize such misdemeanors.

The mischief we see in the waste of coal after access to it has been made, may not yet be altogether or best remediable by enacting scocialistic laws; not as long as it seems feasible to supplant the evil by the lesser ones brought in together with much good by the consolidation of property control. This fixing of conditions may be attained at this day easier than was the settlement in the anthracite regions. While the labor question there is not satisfactory at times, the economical and safe working of the properties is in the main conserved. We must trust there would be intelligent progress in such a change, and an end to the "stupidity against which even the gods fight in vain."

Already we seem to have in the Connellsville region an example of far-seeing policy for large control resulting in peace and economy.

There is, besides that due to bad method of mining, a loss of opened coal due to irregular operation of the works. Two hundred men employed 300 days do better for their employer, as well as themselves, than 300 men sometimes half idle, then under pressure for large output, and perhaps summing up only 200 days' work for the year.

Experience teaches that with settled conditions we need under ruling of the trade for a month at a time, only 10 per cent. excess—for disability—of the number that make full pay, and will have greater safety to works and workers in the regularity of operation.

We know that to save waste of good coal in the ground the whole area of seam should be gotten out by the regular march of working to exhaustion, with systematic breaking of the rocks to the surface; for a squeeze of the roof cannot be averted in widespread partial working exceeding 50 per cent. in the detail. We have no hope of ever getting the inferior quality overlying coal involved in the breaking of the cover, and if a region has valuable seams above they must be mined first.

About Pittsburg we lose only the roof division, as we take away the main coal, there being no considerable other coal seam above in these hills that extend among outcrops. The roof coal, ready open, as we have it—there are 3 or 4 feet, about half coal—it is true, would be worth having in the countries where the ground holds only poor seams and where the jigging of slaty coal is warrantable.

Where our other, the lower productive coal measures of about 300 feet thick, come near the surface, several seams not far apart vertically are about equally mineable, and their getting now should proceed together so that the roof-breaks come regularly down through the panels laid out on like plan of working for each level—successive seam.

But no lower productive measure coals can about here compete with Pittsburgh coal; their irregularity of occ rrence in size and quality is against it. And that great scope underlying the Pittsburgh coal has no value.

There is a great deal of best coal land undeveloped yet, because the

railroad companies do not build into it—having opened too much in wide zones of equal freight charges, and brought about undue cheapening of the whole product in the main markets.

Should not the carrying of raw material in trains of car loads be paid for by a constant charge per car plus a rate per mile, which in refinement should be affected by a factor for gradients in each division of grades according to the motive power? The impulsion to, and constraint against, building railroad extensions should not so much be with coal land or coal trade interests.

Only one-half of the Monongahela river coal passing the locks went on down the Ohio last year. One-half of the coal by rail to and through Pittsburg went through. The rail shipments equaled the river shipments. In other words, of the total, over 11 million tons, to and through the city, one-half was consumed in Pittsburg and vicinity, of which the half was rail, the other half river coal. It appears also that of the 4,000,000 tons coming from all parts to Cleveland the half was cleared.

The badness of weak operators is to blame for the agitation to bring under the laws the qualification of the mine owner or his agent—the superintendent—who is the employer of men and provider of the means and material at the mine for working it safely as well as profitably. The hiring of a certificated mine foreman as pit boss, to be responsible for everything, and of a surveyor to keep up a map, leaves the superintendent in assumption of such scientific and moral responsibility as should be authoritatively examined into, it is held.

The inquiry into the capacity and character of the man who may act in supervision of all the labor at one or more mines is to be not to further the State's interference in detail, but to gain a continuous intelligent and therefore conscientious oversight for betterment of all general conditions. But testing a man to be fit for men to look up to as an employer is socialistic.

I believe men may prove to be good superintendents who range from soldiers able to be officers, to gentlemen of vigorous sense who are with out any special technical training. There has to be discipline at the works, and gaseous mines call for military strictness. The man who controls the individual employment ought to be discreet, impartial, and have a record of good conduct, and he will avail himself of the aid to his judgment afforded by consulting an experienced engineer in emergencies. If a public inquiry will eliminate from authority the pugilistic pretender and sly bad man, it will be wholesome. But how if he be the owner and declines to be bound as an examinee?

A gentleman finding himself, through social influence it may be, the superintendent of coal works, will probably have anticipated the need of knowing something about steam and other power in their applications, and will not fail to study more practically his physics. His other education, that he may now feel keenly was in wrong directions, he can turn to account if he is a bit of a philosopher; for here he has the commonest humanity to deal with and the range of it he may find wide. He will want to look into conditions underground and learn what his pit boss really needs from time to time, and when he discharges him and hires another that has a mine foreman's certificate as required by law, it will be to have more efficiency in fulfilling its requirements.

On the other hand, a coal company's mine foreman may be of the grade to be relied on for the immediate employment and supervision of all the ordinary working force except of shipments and accounting, there being a non-resident manager of this and other local superintendence who is qualified from experience in the requirements, or as an engineer to grow with the requirements, of the business, and have all improvements and routine work thoughtfully laid out and well attended to. The risky condition of affairs is indicated where pit bosses are often changed.

Legislation should provide for filling up oil and gas wells here that are kept open for use so that cutting into them in the future from any coal seam may not be dangerous. In Ohio, by a law passed this year, the owner is required to place on record a map locating the wells drilled on his lands, and the mine inspector may require plugs above a minerable coal seam; while the plugging below is as under Pennsylvania law, with the object of keeping the oil sands from being waterlogged from above on the drawing out of the casing. It has been supposed by oil men that the column of water standing over the plugs in abandoned wells is a safe seal against gas coming out of the depths, but when we find gas coming to the surface at various distances around a plugged well we know the primary object of keeping water from going down has not been attained either. And if above the ground water—say the level of the surface streams—there is open space in the hole, under covered up top, the miner striking into the well will have some gas with the water rushing on him; its source may be the leakage out of upper coal rocks—the open space having become a magazine. Besides, water holds much gas absorbed to let it go under relief of pressure. A record locating wells drilled on the land would put the future miner on his guard, and if care had been taken to keep the holes open to the atmosphere it would add security, but there would be safety for all time if the wells were solidly filled to the top. It is plain that the responsibility can be fixed nowhere if not on the landowner.

Our institute composed of men concerned with coal mining in all capacities, in the regions of which this is the largest of the cities, has engaged itself for years in discussing the affairs of the industry practically and scientifically, and as the conditions will never be found perfect there will always be important subjects at hand to consider.

I trust the public understands that we here are not occupied with the wage rates of the labor. But everybody in earnest about getting the product with safety and economy should favor, from expediency even, bettering the standard of living of the workers by good actual earnings under steadiness of employment. Nominal high wages there are various ways of discounting it is found.

Let us have a large co operative membership and make well known the best that we can do, so that we may command the respect of our intelligent communities for the totality of a business that so many outsiders learn only repellent features of through the newspapers.

The Analysis of Mantles for Incandescent Gas Burners.

Mr. E. Hintz, in the *Zeit. Anal. Chem.*, says that the commercial incandescent mantles of to-day are composed almost entirely of oxide of thorium, ThO_2, to which has been added a small quantity of oxide of cerium, CeO_2, varying from 0.5 to 2.0 per cent. With the exception of a small quantity of lime they only contain traces of impurities, such as nitrate of thorium, and oxides of zirconium, neodymium, lanthanum, and yttrium. The estimation of all these bodies is an extremely delicate operation. To satisfy himself that these impurities have no appreciable influence on the luminous power of the mantle, and therefore that not much notice need be taken of these impurities in the analysis of incandescent bodies, the author has undertaken a series of photometric measurements, from which he has been able to establish the following conclusions:

1. The oxides of zirconium, lanthanum, and yttrium up to 1 per cent. do not increase the illuminating power of mantles composed of pure oxide of thorium. Oxide of neodymium increases it to a slight extent. With a consumption of 111 liters of gas per hour, the addition of 1 per cent. of this oxide increases the illuminating power by 13 Hefner candles.

2. The admixture of 1 per cent. of oxide of neodymium, lanthanum, or yttrium, and the addition of 0.2 to 1.0 per cent. of oxide of zirconium, have no influence on the illuminating power of mantles made from thorium. The influence of 2.0 per cent. of oxide of zirconium is doubtful.

3. The admixture of 1 per cent. of the oxides of zirconium, neodymium, lanthanum, or yttrium, has no influence on the emissive power of thorium-cerium mantles containing 0.5 per cent. of lime. The lime contained in the mantles doubtless comes from the ash of the tissue used in their manufacture. It is this substance which increases the fragility of the mantles, and it should always be eliminated as far as possible.

In collaboration with H. Weber, the author has examined Knorre's method for the estimation of cerium; it is well known that this method consists in acidulating the solution of the cerous salt by sulphuric acid, and transforming it into ceric salt by boiling in presence of presulphate of ammonium. The yellow ceric compound is reduced by dilute peroxide of hydrogen to the state of a colorless cerous salt, and the excess of peroxide of hydrogen is titrated by means of permanganate. Ten atoms Fe = 2 molecules $KMnO_4$ = 5 molecules H_2O_2 = 10 molecules CeO_2; consequently 56 parts Fe = 140 parts Ce = 172 parts CeO_2. To oxidise 0.2 to 0.3 grm. of cerium it sufficies to use 3 grms. of persulphate of ammonium. This method applied to the analysis of thorium-cerium mantles gives good results when carried out *exactly* in the following manner.

The solution (see further on) containing about 1 grm. of ThO_2 and 0.01 grm. of CeO_2 is acidulated with 5 to 7.5 c.c. of dilute sulphuric acid (1 vol. H_2SO_4 + 6 vols. H_2O); it is diluted up to 200 c.c., and a part only of the persulphate of ammonium added. It is then heated to boiling for 2 minutes, cooled to 40—60° C., and a second portion of the persulphate of ammonium added. After a second boiling, followed by a second cooling, the remainder of the persulphate is added, and the whole boiled for 10 or 15 minutes.

Towards the end of the ebullition we add a further 2 c.c. of dilute sulphuric acid, and then cool completely, after which, by means of a burette, dilute peroxide of hydrogen is added drop by drop, until the yellow coloration disappears; we then immediately titrate the excess of peroxide of hydrogen by means of a solution of permanganate.

The presence of nitrates in small quantities does not interfere with the results; but acidification by nitric acid instead of sulphuric acid would lead to too low results.

The simplified method for the analysis of incandescent mantles, proposed by the author, is as follows:

Take at least 12 mantles *before incineration*, cut off the upper and lower extremities, keeping only the middle portions, for the upper parts are frequently impregnated with hardening substance, and the lower parts are likely to contain an excessive proportion of nitrate of cerium. Weigh the middle parts, and thoroughly exhaust them with water to which a few drops of nitric acid have been added. Burn the tissue, melt the residue with bisulphate of potassium, take up with dilute hydrochloric acid, precipitate with ammonia, dissolve the precipitate in nitric acid, add the solution thus obtained to the principal solution, and dilute to a convenient bulk.

1st. We can detect the presence of 1 part of oxide of neodymium Nd_2O_3 in 100 parts of oxide of thorium in a portion of the liquid by its characteristic color, and by the absorption bands observed in the spectroscope.

2d. Precipitate part of the solution with oxalic acid, after having eliminated the excess of mineral acid by evaporation. Collect the precipitate (a) on a filter of hard paper, transfer this precipitate to a beaker, heat with a concentrated solution of oxalate of ammonia, dilute with water, allow to cool, filter again after the solution has been standing for a considerable time, calcine and weigh.

The precipitate may contain a small quantity of thorium, so that even in the absence of neodymium, lanthanum, and yttrium the result in oxide of cerium will be a little too high. At the same time the presence of lime affects the accuracy of the results in the same manner. In any case if the weight of the precipitate does not exceed the actual weight of the oxide of cerium by more than 1 per cent., we may safely assume that the mantles do not contain either lanthanum, neodymium, or yttrium in appreciable quantities. If the divergence is greater than 1 per cent. the precipitate should be redissolved in sulphuric acid, and submitted to complete analysis for the detection and estimation of the earths.

To test the filtered liquid from (a) for oxide of zirconium we evaporate to dryness, calcine gently, re-dissolve in dydrochloric acid, evaporate off the excess of acid, and run the residue on to a glass plate by means of a few drops of water. Drive off this water by evaporation, then add a drop of water and a drop of binoxalate of potassium, evaporate to dryness again, and search under the microscope for the characteristic crystals of the double oxalate of potash and zirconium. The presence of 0.1 per cent. of oxide of zirconium can be recognized by the method we have just described, even when working on only one mantle.

3d. Evaporate off the excess of acid in a part of the solution, and precipitate with oxalic acid; calcine and weigh the precipitate which contains all the rare earths, with the exception of oxide of zirconium. The results are influenced by lime. But with mantles formed of 1.2 per cent. CeO_2, 98.4 per cent. ThO_2, and 0.4 per cent. CaO, there is no particular disadvantage in considering lime as oxide of thorium.

4th. Titrate the cerium in a known volume of the solution by Knorre's method, remembering that the presence of a small quantity of organic matter, resulting from the exhaustion by nitric acid, will necessitate the use of a slightly larger quantity of persulphate of ammonia to that indicated above. In the absence of neodymium, lanthanum, and yttrium, or in the presence of only small quantities of these bodies, the difference between the results of (4) and (3) will give the oxide of thorium.

High Speed Engines.

[A paper read by MR. J. H. DALES, at an Ordinary Meeting of the English Institution of Civil Engineers.]

In applying provisions for eliminating knock in double-acting engines, the author had found that the ordinary rates of rotation could, with practical immunity from overheating, and an absolute freedom from seizure of bearings, be exceeded to the extent of 30 per cent. to 50 per cent. This had been effected by providing a close up, and at the same time expansible, adjustment of bearing brasses, and so reducing the production of heat to only that caused by the rotation of a shaft as distinguished from the usual cause of seizure—namely, the expansive force of the metal of both journal and brasses.

At moderate rates of rotation, say 300 revolutions per minute, an audible knock took place with a $\frac{1}{1000}$ inch clearance in the bearings of double-acting engines, and a rise of temperature of 20° or 30° F., which almost always took place in practice, would expand the bearings more than that amount of clearance, and, therefore, an engine, if fitted with fixed brasses, was always liable, with little or no warning, to become overheated, and to seize in its bearings. The provisions which were made for avoiding the usual consequences of heating were very simple and consisted of a small ram of the hydraulic pressure type, which was made to bear on the adjustable brass of a bearing. On the alternative stroke of an engine, when the working pressure was not on the adjustable brass, the ram was forced through its packing by a spring of sufficient strength to overcome the friction and the inertia of the ram and parts, and in such manner placed the adjustable brass close on its journal. This action caused a slight clearance in the ram cylinder, which was instantly filled by liquid from a reservoir which entered by a back-pressure valve. The shock of the working stroke of the engine acting upon the liquid inside the ram cylinder instantly shut the back-pressure valve and confined the liquid as a packing at the back of the ram, and so maintained the adjustment of the brass which had been made by the spring. Similar fittings were provided on all the reciprocating bearings of an engine which were usually subject to knock.

It had been found that all surfaces of close-up bearings which were not continuous, had to be lubricated separately, as there was not sufficient oil left from the first to supply a second after part had been lost in the joint space. White metal had been found practically necessary at very high rates of rotation, and the risks of its melting out had been guarded against by such a backing of other metal as would not allow of sufficient clearance occurring in such an event as would cause the pistons to knock in the cylinder ends.

The value of close governing had been very much underrated, and economies had been sought in reducing the coal bill by various expensive expedients in other ways, than by increasing the output and quality of work as it could be done by good governing. It could be shown that by running to within 1 per cent. or 1½ per cent. total variation in the speed of an engine, an increase over ordinary results in the quantity of work could be produced, which in many cases amounted in value to more than the whole of the coal bill. The possibilities of close governing by the various types of governor in common use, had been investigated, and it had been found that deadweight loaded governors of the ordinary type, even when compensated for change of position, could not be moved by any less variation of speed than about 2 per cent. from the normal, or a total variation of 4 per cent., taking no account of any work to be performed in the way of moving throttle or expansion apparatus. Spring-load governors with angular arms pivoted, as in the former case, on plain pins, could be moved with a variation of 1½ per cent. from the normal, or a total of 3 per cent., taking no account of the performance of any governing functions. Spring-load governors, fitted in all joints with ball bearings and designed with small relative inertia and high speed, had been made to work auxiliary apparatus with as little variation of speed as 1½ per cent. total and had governed engines within those limits.

Perfect governing could be obtained when (1) the direction of the strains of centrifugal force were not diverted; (2) such strains were directly radial; (3) the friction and inertia of the centrifugal generating parts were reduced to a minimum: (4) the mechanical relations of the governing parts were constant; (5) the inertia of the centrifugal generating parts, whilst very small relatively to the centrifugal forces, were as far as possible in excess of the driven parts of the governing apparatus. These points were embodied in a flywheel governor dealt with, in which the load springs were arranged radially, as also were the spring boxes and guides belonging thereto, so that the centrifugal forces caused no cross strains. The springs formed a large part of the centrifugal weights, and had a peculiar effect upon themselves, which was illustrated by a diagram. The motion of the governor, in performing its functions, was transmitted to the expansion eccentric by means of a spur wheel mounted on a sleeve, which was solid with the eccentric, and was actuated by means of rack teeth formed in the spring box slides, giving a practically constant mechanical effect in the action between the governor and the expansion eccentric. The inertia of the governor was in excess of the driven parts as about 3 to 1, while the centrifugal weights were about 2 per cent. of the total spring load. The total averge centrifugal force of the governor was about 3,000 pounds, and the only cross strains on the spring box slides were those brought about by driving the cut-off eccentric, and those strains were relatively

very small, as the cut-off valve was worked by a rocking shaft and twisting spindle, in order to avoid the friction of a pulling spindle and the effects of the steam pressure on the same. The arrangement could be adjusted so as to govern an engine to 1 per cent. total variation throughout the whole steam range of the expansion gear, which was about ⅛ cut-off from zero, and without racing. The expansion motion was reversible with the same set of parts.

In regard to the possibilities of fine governing, the principles of a cut-off governor were much more favorable than those of a throttle governor in any engine having any cut-off and a reciprocating action. The cut-off admitted of no accumulation of pressure during the closed time of the working stroke, as in the case of a throttle governor, and therefore no action of a governor working a cut-off was required stroke by stroke, as in the case of any attempt at fine governing by a throttle. In the case of the cut-off, a simple change of position of the governor was alone needed to alter the steam supply; while in the case of the throttle, not only was a change of position necessary, but a constant approximate cut-off action, which had to be produced by a constant fluctuation of the speed of the engine, and which defeats the very effect of regular running which it is desired to produce. A throttle would be perfectly suitable to govern a true rotary engine, that was one of constant torque, but its principles were opposed to perfect governing of any engine having any cut-off.

The adjustment provisions dealt with increased the power value of an engine and its steam economics, and rendered it more reliable than ordinary fixed bearings at low speeds, while dead close governing increased the quantity and quality of work produced often to an extent of equal value to the whole of the coal bill. High power in small engines effected a saving in first cost, attention, maintenance, space and buildings; and high speed, in the case of electric lighting, considerably reduced the ordinary cost of dynamos. Also, under full load, steam economies could be had, in small engines, equal to those which were obtained from large engines, despite the fact that the clearances of small engines were necessarily greater proportionately than those of large or, rather, long stroke engines. This was accounted for by the relatively small cylinder losses in engines running at a high rate of reciprocation.

Debate on Two Questions Asked at the Last Meeting of the Northwestern Electrical Association.

At the Seventh Annual Meeting of the Northwestern Electrical Association, held in Milwaukee, Wis., last month, the contents of the Question Box brought out an intesting discussion. The two queries here appended, with the discussion thereon, are well worth close reading and consideration:

Question 1. What is the best way to enlarge the arc, incandescent and motor capacity of a plant that is now "filled up" in all departments?

Question 2. For a plant in a small city, no day circuit, services to midnight only, what method of charging for lights would give best satisfaction to company and consumer?

Mr. Doherty—I might say a few words in regard to the first question. It looks as if the only answer to that question was to build a new plant. But a great many interesting points might be brought out in that question; for instance, if the station was filled up in every department, yet the managers might not have the money, or feel that it was advisable, to put in a complete new plant, new arc machines, new alternators, and might want to make an increase in one line this year and in another line the next. There are a dozen different ways of doing that—putting arc lamps on the transformers around the station, cutting them in and out with knifeblade switches, etc. I do not think that there is an automatic switch now on the market for alternating currents, but one is expected soon. There is a switch for the direct current working by clockwork, throwing lights on and off, on circuits like the Edison, and where they do not use series lamps. I would not undertake to answer that question, for one moment, but I suggest that an alternator with reserve capacity for future needs to be put in that would enable them to lighten up the load on the arc machine and take on more lamps. Then they could transfer service back and forth, between one department and another, and in that way save considerable on the enlargement of the plant.

Mr. Schott—There is only one way to answer this first question, outside of the arc end of it. On the incandescent and power end of it, the true way to take care of that is to put it on the meter basis. On the arc end, if the station be equipped with straight-series arc apparatus, while it can be metered, it is not exactly what you may term practical. I know of one town that within the last two or three years was placed in this position: They had overhead circuits and were forced within a given district to go underground. In that underground district they had in the neighborhood of about 25 miles of arc circuit, while the question of ducts, cables, etc., necessary to place series arc commercial work underground, meant quite a large sum of money. On the other hand, in changing from the series arc at a flat rate, over to the incandescent circuits and on a meter basis, it meant quite a loss in the income, but after considering this matter very thoroughly they finally concluded to adopt the inclosed style of lamp on a meter basis. The result was that the increase in cables, etc., was very slight over what they had been obliged to use before in operating their incandescent end of it, and the first year the loss in income was $21,000; but the third year has proven that the average rate received for arc lamps connected is higher than when it was on a flat rate basis. They avoidcd the increasing of the capacity of the station, and the additional investment in conduits and cables. As a rule, when customers change from the series arc to the inclosed arc, they are not as well satisfied as they were before, for the reason that the series arc light will throw more light on the ceiling, but after the service has once been put in effect the customer grows used to it and knows that he can turn the arc on any hour of the day or night, and sees the advantage of it. In two years you can convert any man, no matter how far he has been on the other side of the fence. I think the only way to take care of the business and provide for additional capacity without increasing your station, is as stated.

Mr. Livermore—In regard to the incandescent end of the business, this question depends largely on the efficiency of the incandescent lamp. If a plant is wired up altogether for 4-watt lamps and 3.6 watts, if the regulation of that plant is good enough, they can use a 3-watt lamp and increase their capacity very largely in that way on the incandescent lamp and on the alternating business. Where they are using the new 3-wire transformers which are made now of very high efficiency, a very material saving can be made in the dead load carried by every alternator and in every plant using the old type of transformers made previous to four or five years ago. I know in my case I have made a plan which I am going to carry into effect at once, by which I replace 49 old-type, 2-wire transformers, with 11 3-wire secondaries. This change alone in the dead load carried by my alternating machine will make a difference of 8 amperes and 1,100 volts, and in that way you can make a very material saving.

Mr. Debell—The question under discussion was suggested by myself, and I will state that the largest part of the business of our plant is done on a meter basis, and that as high efficiency of lamp is used as we think the station will stand in an alternating system. We have concluded that the only way to increase our capacity in the direction needed is by putting in additional machinery, and what we principally wish to know is, what kind of machinery would be best to put in, the simplest arrangement that would allow us to take on more business. The machinery in use now is an alternating system for incandescent lights, straight arc series—regular series arcs—for doing street and commercial lighting, and 500 volt power service.

Mr. Frund—In reference to these questions, I would say, we had 3 years ago two 60-kilowatt alternators, very well loaded on nearly 4-watt lamps, and the question arose as to the advisability of putting in more machinery. On a 100-volt secondary it was a pretty hard matter for us under test submitted to get anywhere a 3-watt lamp, but we finally had a manufacturer that furnished us a 3½-watt lamp; and in that way we avoided putting in new machinery for the time being, but in a very short time that extra installation was taken up. We were then running on a flat rate very satisfactory to us, but it meant another expenditure of something like $8,000 on the incandescent plant for new business. The question resolved itself into this, whether or not it would pay us to put in meters or go on with a flat rate, and run the risk of reducing our income on a meter rate. Having seen some of the results in other plants where the meter rate reduced the income considerably we were in doubt, but we finally resolved to put in meters, and the consequence of this was that a 60-kilowatt machine did the work where we required two 60-kilowatts before. It took us nearly 2 years to get on our feet, but now we have a very satisfactory service. We have no trouble at all now on meters, or with meter rates.

Mr. Thayer—I think really that the most valuable thing for us to know would be what the other plants have actually done, rather than what we would do if the case were presented. Take the case at Cedar Rapids, near where I live. There is there a typical plant of the old style—that is, with alternating current, small transformers, 500-volt

power circuit and series arcs. They have reached the limit of their station, and last year they began putting in two-phase alternators and throwing out a good many of their old transformers, and they are gradually changing their power business, wherever practicable, into 2-phase motors, with the intention of ultimately throwing out all of the 500 volt system and running their alternators for the day load. The series arcs on street circuits they would keep, but they are installing a good many more. All their extra arcs are going on the alternators. They are using a few big alternators rather than a number of the small types of the smaller machines. That is the way one large plant solves the question.

Mr. Grover suggested that a committee be appointed to establish uniform rates for power service. Regarding flat versus meter rate in two plants which he had changed over from contract to meter, he found that the revenue went down the first year about 20 per cent., and operating expenses decreased about 33 per cent., and the second year the income increased 50 per cent., and the operating expenses still remained about 30 per cent.

Mr. Thayer—On the question of changing over from contract to meter our plant, like most of the rest, was once entirely on a contract basis; but we started out first with the houses, putting them in at 18 cents per 1,000 watt hours, and, of course, that was entirely new business, and we had no trouble; but the hard point was to get the stores to put in meters wherever possible. Now, where a man has a certain number of lights, and he burns them regularly every night, and certain hours, we do not say much to him; but if a customer wants light which he expects to burn at unusual or intermittent times, we either name him a high contract rate or a meter rate, such as would be to his advantage to go on. But we make the distinction also that a good many plants do not, in giving him a discount for long hour service, and not on the amount of light used. It may be that he is a customer who closes early, and uses an immense number of lights, up to our capacity, and then he shuts his lights off. Our first efforts were to charge him a rate of 33 cents a month per lamp, and 5 cents a thousand watts, by meter. That was made to fit into the rate that the customer had been receiving. We have followed practically the rates of the Chicago Edison Company, charging 20 cents a thousand watt hours on a 3.1 watt lamp basis for the customer's average the year round, and half a cent for all succeeding hours. That rate gives us an equivalent rate of about 13½ cents a thousand watt hours in a store, as the lights are usually burned, and it has the additional advantage that if a man wants to take extra long hours, instead of paying in the neighborhood of 14 or 15 cents, he is only charged 10 cents for that extra burning.

For the first hour during the six lighter months, and the first hour and a half during the six winter months we make a modification, and that is to forestall the time when we will put in meters, and if a man loads up his store for the holiday season, he has got to pay for it, but at present it has the advantage of equalizing bills, cutting down the heavy winter bills and making the summer bills a little larger. I think you will find in changing over to a meter basis, you have trouble with heavy winter bills, and if you get a system of discount that you can cut down your heavy winter bills, you may get more from your customer by the year than you can by letting his bills run away down in summer time and away up in winter time. We go on the basis that a short hour customer has got to pay a large price, and a long hour customer will get a very substantial reduction on the rates, and so far we are gradually working over on to a meter basis. We have got, I think, 40 or 42 per cent. now on meters, and that has all been done within 3 years. So far we have kept right at it, and whenever we can nail a customer to get him on meter, we do it, and in time we will have pretty nearly everybody on meters.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

A CORRESPONDENT in Savannah, Ga., writing under date of Jan. 26, 1899, says:

DEAR JOURNAL: This evening Judge Speer signed the final order returning the property of the Macon (Ga.) Gas Light and Water Company to its owners, and that without the necessity for sale, foreclosure, or loss of charter or franchise rights. This result has been attained by 4½ years of hard work, and by the common sense, forbearance and business-like co-operation of the security holders and creditors of the Company. In his final address from the bench, Judge Speer complimented those engaged in this work, and further said it was the first experience of the Court, where such a property had been maintained in its integrity and returned to its owners in better condition than when taken by the Court, and all without the expense and loss incident to foreclosure and sale. The owners resume possession February 1st.

RESPECTING the above welcome information, our correspondent might safely have further added that the brunt of the delicate negotiations connected with this forbearance on the part of the security holders and creditors of the Company rested with Mr. Arthur E. Boardman, in which negotiations he also had the active support and countenance of Mr. Walter Wood. We congratulate them upon the success that has crowned their tact and persistence, and wish them the fullest possible measure of success in respect of the development of the Company's future trading. In this connection much commendation is due to Receiver Tinsley, whose management of the Company when it was in his custody was managed by straightforwardness equal to that which characterized the negotiations of Messrs. Boardman and Wood.

MR. T. W. MARSH and associates have petitioned the Connecticut Legislature for the right to construct and operate a gas works in the town of Litchfield.

THE regular quarterly dividend of 1½ per cent., by the Peoples Gas Light and Coke Company, of Chicago, has been declared. It is payable the 25th inst.

THE stockholders of the Middletown (O.) Gas Company have elected the following Directors: John Auer, W. L. Deschant, C. E. Denny, Frank Gallaher, W. O. Barnitz and T. E. Reed.

THE Massachusetts Legislature is considering a bill to enable all cities and towns accepting the Act to come under the Act passed in 1897, prescribing that the gasfitters of Boston should be regularly licensed, such license to be obtainable only upon the certificate of a board of examiners that the licensee had passed their questioning creditably. The present bill also provides for the licensing of those engaged in electric fitting.

AT the annual meeting of the Yonkers (N. Y.) Gas Light Company the following Directors were chosen: W. W. Scrugham, Robt. P. Getty, Samuel D. Babcock, James Slade, John Kendrick Bangs, Harold Brown, Alfred Jones, Henry A. Robinson and Alexander S. Cochran.

THE consolidation of the gas, electric light and railway systems of Charleston, S. C., is to all intent and purpose effected. At the close of January over seven-ninths of the shares in the Charleston Gas Light Company had assented to the terms proposed by the Baltimore syndicate that is carrying on the transaction.

THE following is the text of the official notice announcing the reduction in gas rates by the Williamsport (Pa.) Gas Company: "On and after February 1 the price of gas will be $1.60 per 1,000 cubic feet for illuminating purposes, and $1.35 per 1,000 cubic feet for heating purposes, where a meter is especially placed for that purpose. In addition to the above reduction a discount of 10 cents on the price of a thousand cubic feet will be given in both cases, where the bill is paid on or before the 10th day of the following month, at the office of the Company, 152 West 4th street." This schedule marks the second reduction made by the Company since the new proprietors took charge, August 1, 1898.

MESSRS. Hotchkiss, Bros. & Co. have secured the contract for the erection of the buildings to house the gas plant that is being constructed by the Torrington (Conn.) Electric Light Company. The buildings, which are to be fireproof, are to be three in number, and are to have these dimensions: Generator house, 52 feet by 30 feet; engine and boiler house, 40 feet by 30 feet; purifying house, 22 feet by 60 feet. Brick will be used in the construction, and the roofs are to be of iron, from designs and construction furnished by the Berlin Iron Bridge Company.

WE regret to report the death of Mr. Adin H. Smith, who was the first President of the Athol (Mass.) Gas Company. His death occurred in Athol, the afternoon of Saturday, January 21st.

MAYOR BROWN, of Rockford, Ills., acting under a resolution of the City Council, has appointed Alderman Sterling Shepherd, Harbison, Pearson and McEvoy a committee "to investigate the gas furnished by the Rockford Gas Light and Coke Company."

THE Passaic and Bergen Gas Company, to sell gas throughout the New Jersey counties of Passaic and Bergen, has been incorporated by Messrs. A. H. Tuttle, George S. Philler and Elmer Smalling. The

initial capitalization is put at $100,000. This is taken to mean the Company that proposes to take over the gas companies now doing business in the named counties.

At the annual meeting of the Clyde (N. Y.) Gas and Electric Company the officers chosen were: Directors, C.W. Field, G. H. Lang, L. L. Moses, Edward Moir and John M. Moir; President, Charles W. Field; Vice-President, G. H. Lang; Secretary and Treasurer, L. L. Moses.

The Massachusetts Board of Gas and Electric Light Commissioners has given permission to the Attleboro Gas Company to issue $46,400 in stock for the purpose of taking over in legal form the hitherto unincorporated property known as the Attleboro Gas Light Company.

The Binghamton (N. Y.) Gas Engine Company, to manufacture and sell gas engines, with principal place of business in Binghamton, has been incorporated by Messrs. M. L. Deyo, H. A. Niles, D. H. Carver, R. H. Deyo, William B. Carver, Israel T. Deyo and B. Rumsey.

On the 13th inst. the shareholders of the Provident Gas Company will consider a proposition to increase the capital stock of the Company from $100,000 to $200,000. This is the concern that proposes to operate an opposition works in Springfield, Ills.

The Lowell (Mass.) *News* a few days ago devoetd a portion of its editorial page to an argument supporting the theory that the city of Lowell should create and maintain the office of gas meter inspector, an official who "could make himself very useful in settling disputes over gas bills which are claimed to be excessively high." The *News* man does not seem to know that the people of Lowell, in common with the residents of every other city in Massachusetts, may avail themselves at any time of the services of the State Inspector of Gas and Meters, whenever they think their gas meters are playing them false.

At the annual meeting of the East Boston (Mass.) Gas Company the following officers were elected: Directors, John Thompson, George L. Thorndike, William B. Pigeon, Bradlee Whidden, Augustus L. Thorndike, John A. McKee and Stephen H. Whidden; President, John Thompson; Treasurer and Clerk, J. Walter Andrews.

Prof. Wilson, who has charge of the matter of testing the gas supplied in the city of Baltimore, Md., has submitted to the City Council an ordinance to regulate there the manufacture of acetylene gas and the storage of calcium carbide. The proposed ordinance is of a decidedly restrictive nature.

The building at 14 Cortlandt street, N. Y., which contained the office and exhibit of the Bayles Engineering Company, was destroyed by fire the night of Monday, January 30th. The drawings, patterns and other valuable assets of the Pantaclinal system were saved, but the Company's letter files, order books and records were destroyed. A line of Pantaclinal mains, about 80 feet long, came through the fire without injury; the water gauge not having been even cracked. The Bayles Engineering Company has taken temporary offices in the Havemeyer building, 26 Cortlandt street. Its business will not be interrupted.

The new holder constructed by the Brooklyn (N. Y.) Union Gas Company, on Beaver street, Jamaica, for the better supply of gas to the residents of that section, has a capacity of 500,000 cubic feet. The Brooklyn Union Company proposes to extend its mains the coming spring to the villages of Hollis, Queens, Springfield and Floral Park.

The title of the amalgamated, gas, electric lighting and street railway combination is to be that of the Charleston Consolidated Railway, Gas and Electric Company. The officers named to manage the concern are: President, J. S. Lawrence, Charleston, S. C.; Vice-President, Francis K. Carey, Baltimore; Secretary and Treasurer, J. Bannister Hall, Baltimore.

At the annual meeting of the Manchester (N. H.) Gas Light Company the officers elected were: Directors, George B. Chandler, Chas. F. Warren, W. M. Barker, N. P. Hunt and W. B. Stearns; President, G. B. Chandler; Treasurer, W. M. Parker; Clerk, N. P. Hunt.

A correspondent in Wilkes-Barre, Pa., incloses the following clipping from the Pittston (Pa.) *Gazette*, dated January 27th: "The franchise and plant of the Pittston Gas Light Company will change hands on February 1st, having been purchased by a Company of Wilkes-Barre investors, who are interested in other local lighting enterprises. The leading spirits of the new Company are Abram Nesbitt, E. W. Mulligan, Liddon Flick, W. P. Billings and John Flanagan; and Edward C. Jones, of New York city. The movement which has resulted in this change was started a month or two since when Messrs. George McDonald and W. H. Rogers offered $207.50 per share for the entire stock of the Gas Light Company, agreeing also to assume the floating indebtedness of the Company, and on this offer received an option. This option was within a few days transferred to the Wilkes-Barre capitalists mentioned above, who, we understand, paid the holders of the option $250 for the same. The capital stock of the Company aggregates $40,000 in $100 shares, and the money to pay for the same was deposited in the First National Bank, subject to checks signed by E. W. Mulligan and Liddon Flick. Mr. Flick was in town to-day receiving stock certificates and paying for them by check. Considerably over a majority of the stock has already been deposited with the First National Bank and paid for by the new owners. We are reliably informed that the new Company, by the introduction of various improvements and economies, hopes to be able at an early date to reduce the price of gas to consumers, who are now paying $1.50 per 1,000 cubic feet. There is some talk also that the new Company is considering the matter of erecting an electric light plant in West Pittston."

Advices from Louisville, Ky., dated January 27th, state that the judgment of the McCracken Circuit Court, in the combined cases of the Paducah Street Railway Company and the Paducah (Ky.) Gas Light Company against the county of McCracken, was affirmed in the Court of Appeals to-day in an opinion by Judge Guffy. The suits grew out of the assessment by the State Board of Valuation and assessment of the property of the corporations for franchise taxation. They sought to enjoin the collection of the taxes assessed, claiming that the franchise tax law was unconstitutional. The lower court sustained a demurrer to the petitions and dismissed the actions. In affirming the judgment of the lower Court the Court of Appeals says: 'We deem it unnecessary to discuss the question involved upon these appeals at length, because the validity of the act in question, as well as the basis upon which the valuation complained of was made, has often been upheld by this Court.'"

Senator Hall is responsible for the introduction in the California Legislature of a bill which provides that no charge shall be collected for gas furnished through meters which have not been tested by meter inspectors appointed by the municipal authorities of cities. Another section fixes the maximum price for gas at $1 per 1,000 cubic feet, which maximum rate, though, applies only to cities "of the first class" in the State—which virtually means San Francisco.

At the annual meeting of the Hoosick Falls (N.Y.) Gas Light Company the officers elected were: Directors, Danforth Geer, Chas. A. Cheney, W. E. Heaton, W. A. Wood, Jr., and James E. Beckett; President, Danforth Geer; Vice-President, W. E. Heaton; Secretary and Treasurer, Chas. A. Cheney.

The Westinghouse Machine Company is about to make its first shipment of gas engines to England; the shipment (which is consigned to London) consisting of 5 engines of a total capacity of 300-horse power.

At the annual meeting of the Northampton (Mass.) Gas Light Company a dividend of 4 per cent. was declared. The officers chosen were: Directors, A. McCallum, C. P. Pierce, John T. Stoddard, S. B. Fuller and C. E. Gould; President, A. C. McCallum; Secretary and Treasurer, C. E. Gould.

The new office building of the Winsted (Conn.) Gas Company, which is situate in the busiest part of Case avenue, will be completed by April 1st.

The Berlin Iron Bridge Company, of East Berlin, Conn., shipped last month several carloads of bridge material for a bridge construction in the Hawaiian Islands. The Berlin Company believes that this is the pioneer shipment of material for the specified construction sent from the United States.

At the annual meeting of the Coldwater (Mich.) Gas Light and Fuel Company the following officers were chosen: President, B. H. Calkins; Vice-President, H. C. Loveridge; Secretary and Superintendent, A. L. Zwisler; Treasurer, F. W. Moore.

At the annual meeting of the shareholders in the Butte (Mont.) Gas Light and Coke Company the reports of the officers were of so satisfactory a nature that the proprietors determined to expend a considerable

(*Continued on page* 193.)

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 32 Pine Street, New York.

The JOURNAL is the official organ of the
NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.
AMERICAN GAS LIGHT ASSOCIATION.
WESTERN GAS ASSOCIATION.
OHIO GAS LIGHT ASSOCIATION.
PACIFIC COAST GAS ASSOCIATION.

TERMS:

SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 Cents.

Notification Respecting Advertising.—Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, FEB. 6, 1899.

(*Continued from page* 192.)

sum of money on the manufacturing and distributing divisions of the system this spring. The officers elected were: Trustees, A. D. Hopper, J. R. Thompson, R. S. Feurtado, C. S. Hopper and A. H. Barret; President, A. D. Hopper; Vice-President, J. R. Thompson; Secretary and Superintendant, R. S. Feurtado; Treasurer, Andrew J. Davis.

A BILL (No. 79 on the House calendar) is before the Michigan Legislature which authorizes the consolidation, in that State, of gas, electric light and street railway companies.

THE adverse report, by Mr. L. L. Merrifield, of Toronto, Canada, on the selection of what is known as the Kelderhouse site for the "proposed" municipal gas works at Buffalo, N.Y., has been accepted by the authorities.

THE plant and franchises of the Phœnix (Ariz.) Illuminating Gas and Electric Light Company have been purchased by Mr. T. W. Pemberton.

A Mammoth Refrigerator.

The Quartermaster's office of the War Department has invited proposals for the erection of a refrigerating plant of unusual size at Manila for the use of the Commissary Department of the United States Army in the Philippines. The plant, as designed, will be about the largest of its kind ever constructed. It will include a number of big ice making machines, a freezing apparatus and numerous cooling rooms. The estimated cost of manufacturing the different parts of the apparatus here and shipping them to Manila, where they will be put together piece by piece, is about about $100,000. The cooling rooms will have a capacity of 1,200 tons of beef, 300 tons of mutton, 100 tons of vegetables, 50 tons of butter and 50 tons of canned goods. Separate refrigerators will be built for every class of supplies, so that meat and vegetables may be kept in good condition for months in the tropical climate. The specifications require that the plant be erected and ready for use within six months after the contract is awarded. The bids were opened last week.

The Market for Gas Securities.

The market for city gas shares during the past week was in flighty mood, the direction of prices being decidedly upward, especially in respect of Consolidated, which was traded in at a maximum of 204¼. A subsequent reaction brought the price yesterday (Thursday) to a minimum of 197¾. The opening to-day (Friday) was 198–198¼. Mutual sold at auction (10 shares) at 310; New Amsterdam common is 33 to 33½; and Standard common is 125 to 132. The boom in Consolidated and the better prices for New Amsterdam were attributed to two causes. The first of these was charged to the developments in connection with the purposes of the Astoria Light, Heat and Power Company, of Astoria, L. I., the managers of which propose to construct a works in or about Steinway, L. I, "to supply gas and electricity to New York city, which may be conducted under and across any and all waters separating the boroughs of Queens, Manhattan and the Bronx. Conductors, mains and pipes for the purpose of supplying gas and electricity may be laid under and across the East River, or any intervening land belonging to the State, city, or any private person at such places as it may determine." The second cause was said to be that the contest for business in this city between the New Amsterdam and Consolidated-Mutual-Standard Companies had slackened considerably. As to the first thought, holders of Consolidated need not fear that the Astoria Company's purposes are in any sense prejudicial to their best interests; in respect of the second thought, all we have to say is that up to noon of to-day the fight is still on. Meanwhile we believe any city gas stock is cheap at the ruling rates.

Brooklyn Union almost reached the 150 mark this week; to day it is 146 to 147. Peoples, of Chicago, continues to advance, as does Western, of Milwaukee—the latter is bound to cross par speedily. Bay State is being freely bought and sold, and recent quotations in it are fairly well maintained. Lacledes are also in good demand.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

Feb. 6.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$37,730,000	100	198	198¼
Central Union, Bonds, 5's.	3,000,000	1,000	107½	108½
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	300	310
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	..
New Amsterdam Gas Co.	13,000,000	100	33	33½
Preferred	10,000,000	100	66¼	67½
Bonds, 5's	11,000,000	1,000	103¼	104
Northern Union, Bonds, 5's.	1,250,000	1,000	94½	95½
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	111	113
" 1st Con. 5's	1,500,000	..	107½	108½
Richmond Co., S. I.	348,850	50	70	..
" Bonds	100,000	1,000	..	
Standard	5,000,000	100	125	132
Preferred	5,000,000	100	145	152
Bonds, 1st Mortgage, 5's	1,500,000	1,000	112	114
Yonkers	299,65	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	146	147
" " Bonds (5's)	15 000,000	1,000	118	.
Bay State	50,000,000	50	7⅜	7½
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works.. .	450,000	100	..	..
" 1st Mtg. 5's	450,000	1,000	..	.
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	92	..
2d " " "	3,000,000	1,000	..	80
Buffalo City Gas Co.	5,500,000	100	14	15
" " Bonds, 5's	5,250,000	1,000	93	93½
Central, San Francisco	2,000,000	..	105	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Columbus	1,144,700	100	70	75
1st Mortgage	1,207,000	1,000	101	103½
Consumers, Jersey City	2,000,000	100	86	90
" Bonds	600,000	1,000	104	105
Cincinnati G. & C. Co.	8,500,000	100	201½	2 3
Consumers, Toronto	1,600,000	50	184½	187
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Consolidated, Baltimore	11,000,000	100	68	68½
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's.	1,000,000	..	..	..
Equitable, 1st 6's.	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	..
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	380,000	1,000	80	84
Consolidated G. & E. Co.'s., Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co.	4,560,000	50	65	65½
" Prior Lien 5's	4,546,000	1,000	94¼	94½
Detroit Gas Co., 5's	423,000	1,000	95½	96
" Inc. 5's	31,000	100	..	..
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	68	70
" Bonds	2,000,000	..	80	82
Grand Rapids Gas Lt. Co..	1,000,000	50	..	..
" 1st Mtg. 5's	1,125,000	1,000	..	.
Hartford	750,000	25	..	145
Indianapolis	2,000,000	..	100	105
" Bonds, 6's	2 650,000	..	105	106
Jackson Gas Co	250,000	50	..	..
" 1st Mtg. 5's	250,000	1,000	..	..
Jersey City	750,000	20	210	..
Lafayette Gas Co., Ind.	1,000,000	100	68	70
Bonds	1,000,000	1,000	81	86
Louisville	2,570,000	50	106	108
Laclede, St. Louis	7,500,000	100	54	54¼
Preferred	2,500,000	100	95	97
Bonds	10,000,000	1,000	107½	108
Madison Gas & Elec. Co.	400,000	100	..	..
" 1st Mtg. 6's	350,000	1,000	..	..
Montreal, Canada	2,000,000	100	200	..
Newark, N. J., Gas Co.	1,000,000	..	200	220
Bonds, 6's	4,000,000	..	128	130x
New Haven	1,000,000	25	252	..
Nashville Gas Lt. Co.	1,000,000	50	110	..
Oakland, Cal.	2,000,000	..	53⅛	55
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	114	114⅜
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,00	2,000	111⅛	112
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	240	250
Rochester Gas & Elec. Co..	2,150,000	50	52	..
Preferred	2,150,000	50	103	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	88½	89
St. Paul Gas Light Co.	1,500,000	100	50	52
1st Mortgage 6's	650,000	1,000	82	85
Extension, 6's	600,000	1,000	..	..
General Mortgage, 5's..	2,428,000	1,000	80	82
St. Joseph Gas Co	1,000,000	100	..	..
" 1st Mtg. 5's	750,000	1,000	..	..
Syracuse, N. Y.	1,750,000	100	18	20
Bonds	1,612 000	1,000	85	89
Washington, D. C	2,000,000	20	260	..
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	100	97	97¾
Bonds, 5's	3,330,500	.	106	108
Wilmington, Del.	550,000		204	206

Advertisers' Index.

GAS ENGINEERS.

Page

Wm. Henry White, New York City..... 211
Fred. Bredel, Milwaukee, Wis..... 198
Geo. R. Rowland, New York City..... 211
The Western Gas Construction Co., Fort Wayne, Ind.... 180
Humphreys & Glasgow, New York City..... 195
American Gas Co., Phila., Pa..... 198
David Leavitt Hough, New York City..... 213
Economical Gas Apparatus Construct'n Co.,Toronto,Ont. 211
Baxter & Young, Detroit, Mich..... 195
United Gas Improvement Co., Phila., Pa 208

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md..... 209
United Gas Improvement Co., Phila., Pa..... 208
Burdett Loomis, Hartford, Conn..... 210
National Gas and Water Co., Chicago, Ills..... 205
Economical Gas Apparatus Construct'n Co.,Toronto, Ont. 211
The Western Gas Construction Co., Fort Wayne, Ind.... 180
Humphreys & Glasgow, New York City..... 195

GAS WORKS APPARATUS AND CONSTRUCTION.

James R. Floyd's Sons, New York City..... 212
Continental Iron Works, Brooklyn, N. Y..... 210
Deily & Fowler, Phila., Pa..... 212
Kerr Murray Mfg. Co., Fort Wayne, Ind 208
Stacey Mfg. Co., Cincinnati, Ohio..... 211
Bartlett, Hayward & Co., Baltimore, Md..... 209
Davis and Farnum Mfg. Co., Waltham, Mass..... 208
R. D. Wood & Co., Phila., Pa..... 210
Isbell-Porter Company, New York City..... 210
Fred. Bredel, Milwaukee, Wis..... 198
United Gas Improvement Co., Phila., Pa..... 208
National Gas and Water Co., Chicago, Ills..... 205
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 211
The Western Gas Construction Co., Fort Wayne, Ind.... 180
Humphreys & Glasgow, New York City..... 195
Gas Engineering Co., Pittsburgh, Pa..... 208
American Gas Co., Phila., Pa..... 198
Logan Iron Works, Brooklyn, N. Y..... 212
Riter-Conley Mfg. Co., Pittsburgh, Pa..... 211
Baxter & Young, Detroit, Mich..... 195
Berlin Iron Bridge Co., East Berlin, Conn..... 197
G. Shepard Page's Sons, New York City..... 195

SCRUBBERS AND CONDENSERS.

R. D. Wood & Co., Phila., Pa..... 210
James R. Floyd's Sons, New York City..... 212
Continental Iron Works, Brooklyn, N. Y..... 210
Gas Engineering Co., Pittsburgh, Pa..... 208
Logan Iron Works, Brooklyn, N. Y..... 212
Riter-Conley Mfg. Co., Pittsburgh, Pa..... 211

TAR AND CARBONIC ACID EXTRACTOR.

R. D. Wood & Co., Phila., Pa..... 210

AMMONIA CONCENTRATORS.

Michigan Ammonia Works, Detroit, Mich..... 195
Gas Engineering Co., Pittsburgh, Pa..... 208

GAS METERS.

John J. Griffin & Co., Phila., Pa..... 216
American Meter Co., New York and Philadelphia..... 215
Helme & McIlhenny, Phila., Pa..... 215
D. McDonald & Co., Albany, N.Y..... 213
Nathaniel Tufts Meter Co., Boston, Mass..... 214
Maryland Meter and Mfg. Co., Baltimore, Md..... 214
Metric Metal Co., Erie, Pa 215
Keystone Meter Co., Royeraford, Pa..... 214
Detroit Meter Company, Detroit, Mich..... 215

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia..... 215
John J. Griffin & Co., Phila., Pa..... 216
D. McDonald & Co., Albany, N. Y..... 213
Helme & McIlhenny, Phila., Pa..... 215
Nathaniel Tufts Meter Co., Boston, Mass..... 214

GAS AND WATER PIPES.

Ohio Pipe Co., Columbus, Ohio..... 213
M. J. Drummond & Co., New York City..... 213
R. D. Wood & Co., Phila., Pa..... 210
Warren Foundry and Machine Co., New York City..... 213
Donaldson Iron Co., Emaus, Pa..... 213
Utica Pipe Foundry Co., Utica, N. Y..... 213

PIPE CUTTERS.

The Anderson Pipe Cutter Co., East Boston, Mass..... 195

GAS MAIN STOPPERS.

Safety Gas Main Stopper Co., N. Y. City..... 195

STEAM BLOWER FOR BURNING BREEZE.

H. E. Parson, Brooklyn, N. Y..... 205

GAS COALS.

Penn Gas Coal Co., Phila., Pa..... 207
Perkins & Co., New York City 206
Despard Gas Coal Co., Baltimore, Md..... 207
Westmoreland Coal Co., Phila., Pa..... 207
Berwind-White Coal Mining Co., New York and Phila... 206

CANNEL COALS.

Perkins & Co., New York City 206

GAS ENRICHERS.

Standard Oil Co., New York City 207
The Sun Oil Co., Pittsburgh, Pa..... 207

COKE CRUSHER.

C. M. Keller, Columbus, Ind..... 207

GAS GAUGES.

The Bristol Co., Waterbury, Conn..... 196

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City 205
Isbell-Porter Co., New York City..... 210
R. D. Wood & Co., Phila., Pa..... 210
Wm M. Crane Co., New York City 196

CEMENTS.

C. L. Gerould & Co., Mount Vernon, N.Y..... 200

RETORTS AND FIREBRICKS.

J. H. Gautier & Co., Jersey City, N. J..... 200
B. Kreischer & Sons, New York City..... 200
Adam Weber, New York City..... 200
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 200
Cyrus Borgner, Phila., Pa..... 200
James Gardner, Jr., Pittsburgh, Pa..... 200
Henry Maurer & Son, New York City..... 200
Baltimore Retort and Firebrick Co., Baltimore, Md..... 200
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 200
Brooklyn Firebrick Works, Brooklyn, N. Y..... 200

REGENERATIVE FURNACES.

Bartlett, Hayward & Co., Baltimore, Md..... 209
Fred. Bredel, Milwaukee, Wis..... 198
J. H. Gautier & Co., Jersey City, N. J..... 200
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 200
Adam Weber New York City..... 200

SELF-SEALING MOUTHPIECE DOORS.

Isbell-Porter Co., New York City..... 210
Continental Iron Works, Brooklyn, N.Y..... 210
Logan Iron Works, Brooklyn, N. Y..... 212
R. D. Wood & Co., Phila., Pa..... 210

INCANDESCENT GAS LAMPS.

Welsbach Commercial Co., Phila., Pa..... 202

MICA GOODS.

The Mica Mfg. Co., New York City..... 196

BURNERS.

C. A. Gefrorer, Phila., Pa..... 210
Wm. M. Crane Co., New York City. 196
D. M. Steward Mfg. Co., Chattanooga, Tenn..... 195

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn..... 195

STREET LAMPS.

Welsbach Street Lighting Co., New York and Phila..... 204

PURIFYING MATERIALS.

Connelly Iron Sponge and Governor Co., New York City 205
Greenpoint Chemical Works, Brooklyn, N.Y..... 205
Gas Purification and Chemical Co., Ltd., London..... 205
van Baarda & Co., Dusseldorf-on-the-Rhine..... 196

EXHAUSTERS.

The P. H. & F. M. Roots Co., Connersville, Ind..... 199
Isbell-Porter Company, New York City..... 210
Connelly Iron Sponge and Governor Co., New York City 205

VALVES.

Ludlow Valve Manufacturing Co., Troy, N. Y. 196
Chapman Valve Manufacturing Co., Boston, Mass..... 156
R. D. Wood & Co., Phila., Pa..... 210
Continental Iron Works, Brooklyn, N. Y..... 210
The P. H. & F. M. Roots Co., Connersville, Ind..... 199
Isbell-Porter Co., New York City..... 210
The Western Gas Construction Co., Fort Wayne Ind.... 180

ELECTRICAL APPARATUS.

Wm. Henry White, New York City 211

GAS ENGINES.

Backus Water Motor Co., Newark, N. J..... 158

ENGINES AND BOILERS.

The Hazelton Boiler Company, New York City..... 195

PURIFIER SCREENS.

John Cabot, New York City..... 196

GAS STOVES.

American Meter Co., New York and Philadelphia..... 201
Maryland Meter and Manufacturing Co., Baltimore, Md. 214
Keystone Meter Co., Royersford, Pa..... 214
Wm. M. Crane Co., New York City..... 196
Detroit Stove Works, Detroit, Mich..... 159

GASHOLDER TANKS.

J P. Whittier, Brooklyn, N. Y..... 196

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md..... 209
Continental Iron Works, Brooklyn, N. Y..... 210
Deily & Fowler, Philadelphia, Pa..... 212
Davis & Farnum Mfg. Co., Waltham, Mass..... 208
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 208
Stacey Mfg. Co., Cincinnati, Ohio..... 211
R. D. Wood & Co., Philadelphia, Pa..... 210
Logan Iron Works, Brooklyn, N. Y..... 212
Riter-Conley Mfg. Co., Pittsburgh, Pa..... 211

BOOKS, ETC.

Newbigging's Handbook..... 204
Scientific Books..... 206
Digest of Gas Cases..... 207
Practical Photometry..... 200
Gas Flow Computers..... 207
Hughes' "Gas Works"..... 205
Gas Engineer's Pocket-Book..... 197
Excerpts from Reports of Gas Commissioners..... 124
Poole on Fuels 209

LIDA AMES WILLIS,

(Lecturer the Bay View Assembly Cooking School)

Lecturer and Demonstrator of Pra tical Cookery.

For special arrangement with **Gas Companies,** Address SECRETARY, THE EXTENSION COOKING SCHOOL.

1235-4t 38 East 32d Street, Chicago, Ills

A CARD TO GAS COMPANIES.

The attention of officers of Gas Companies is respectfully invited to a patent granted to the undersigned, published and illustrated in the AMERICAN GAS LIGHT JOURNAL of January 23, 1899. It does not interfere with any other patents.

The inventor desires to dispose of the same by the sale of shop or State rights, upon reasonable terms *to Gas Companies*, and offers his own services as an Expert and Consulting Engineer to such, in all matters connected with the business. Address

FREDERIC EGNER,

1234-tf 188 Water St., Morristown, N. J.

Geo. Shepard Page's Sons.

GAS MACHINERY.

Correspondence Solicited.

69 Wall Street, New York City.

Position Wanted

As Superintendent or Manager of Gas Works.

Eight years with present Company. Good reasons for making change. Address

1233-3 "E. L. M.," care this Journal.

POSITION WANTED

As Superintendent or Manager

By a thoroughly competent young man with 15 years' experience as Superintendent of works and in the remodeling of same. Address

1233-4 "H.," care this Journal.

FOR SALE.

A Second-Hand Set of Four Purifying Boxes, including dry Center-Seal—12-inch Connections, and **Two Hoisting Carriages.** Boxes are 12 feet by 18 feet by 3 feet 6 inches deep; are in good condition, and only sold because have been replaced by larger Boxes and will be sold at a low price.

For terms, etc., address

PORTLAND GAS LIGHT CO.,

1228-tf Portland, Me.

For Sale.

A Small Gas and Electric Light Plant,

in a Southern city of 3,800 inhabitants.

Address FORT WAYNE ELECTRIC CORPORATION,

1097-tf Fort Wayne, Ind.

Utilize Your Gas Liquor.

NO EXTRA LABOR OR OPERATING EXPENSES.

Ammonia Concentrator,

Not Expensive. Write to

STROH & OSIUS, Pat'ees, or Mich. Ammonia Works, Detroit, Mich.

BAXTER & YOUNG,

CONTRACTING AND CONSULTING GAS ENGINEERS.

Examination and Values Ascertained of Artificial and Natural Gas Properties.

COMPLETE GAS WORKS ERECTED.

Artificial and Natural Gas Mains Furnished and Laid.

CORRESPONDENCE SOLICITED.

OFFICE: WAYNE COUNTY BANK BUILDING,

Rooms 201 & 202. DETROIT, MICH.

GAS EXPERTS INDORSE

Steward's

SPECIAL BURNERS.

Now in use by THE LARGEST Gas Companies in AMERICA.

The D. M. Steward Mfg. Co.,

CHATTANOOGA, Tenn. AND 107 CHAMBERS ST., New York City.

"THE MINER"

Globe Street and Boulevard Lamps.

Cheapest and Best.

THOUSANDS IN USE WITH INCANDESCENT BURNERS.

Send for Catalogues.

THOMAS T. W. MINER,

821-823 Eagle Av., N. Y.

YOU CAN GET A PATENT

For any Invention. Send me particulars and a rough sketch for advice, free.

IMPORTANT to have your attorney at Washington, saving time and expense.

HENRY S. THORNBERRY, Patent Solicitor, 1427 F STREET, N. W., WASHINGTON, D. C.

GOODMAN

GAS MAIN STOPPER

For Shutting Off Gas in Mains Temporarily during Alterations or Repairs.

For Particulars Address

SAFETY GAS MAIN STOPPER COMPANY,

211 East 116th Street, New York.

ALEX. C. HUMPHREYS, M. E., M. Inst. C. E. ARTHUR G. GLASGOW, M. E., M. Inst. C. E.

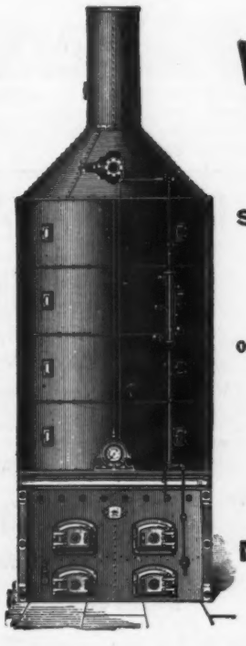
HUMPHREYS & GLASGOW,

BANK OF COMMERCE BLDG., 31 Nassau Street, New York.

9 VICTORIA STREET, London, S. W., England.

CONSULTING GAS ENGINEERS AND MANAGERS.

GAS PROPERTIES PURCHASED.



HIGH-PRESSURE

WATER-TUBE BOILERS.

THE HAZELTON OR PORCUPINE BOILER

IN 50 to 500 H. P. UNITS.

SINGLE BOILERS OR COMPACT BATTERIES. GREAT SAVING OF FLOOR SPACE AND FUEL.

LARGE-SIZE BOILERS IN STOCK.

Our new book, "The Generation of Power," will be mailed on request.

THE HAZELTON BOILER CO.

Sole Proprietors and Manufacturers.

ALSO BUILDERS OF

Stacks, Tanks and Miscellaneous Metal Work.

GENERAL OFFICE:

No. 716 E. 13th ST., New York, U.S.A.

Cable Address, "Paila," New York.
Telephone Call, 1229-18th Street, New York.

THE ANDERSON Patent Cutter Carrying Link

Made in all sizes.

Will cut from 2 in. to 24 in.

Pipe Cutting Tool

For Cutting Cast, Wrought Iron, Gas & Water Pipes.

THE ANDERSON PIPE CUTTER COMPANY, Manufacturers, 163 Liverpool st., E. Boston, Mass
N. Y. Office, 135 Greenwich St
C. H. TUCKER, Jr., Manager.

WALDO BROS., 102 Milk Street, Boston, Mass.

WILLIAM M. CRANE COMPANY,

Office and Showrooms: 1131 and 1133 BROADWAY.

Gas Appliances for every purpose, and all up to date.

GAS HEATING STOVES,
GAS FIRES,
GAS RADIATORS,
GAS LOGS,
GAS CANDY STOVES,
GAS GRIDDLES,
GAS FURNACES,
GAS IRONS,
GAS SIGNS,
GAS WATER HEATERS,
GAS KILNS,
GAS LAUNDRY STOVES,
GAS OVENS,
GAS PLATE WARMERS,
GAS OYSTER STEWERS,
GAS CONTROLLERS,
GAS BROILERS,

GAS RANGES,
GAS SOLDERING STOVES,
GAS STEAM TABLES,
GAS CREMATORIES,
BRAY BURNERS,
GAS BURNERS,
GAS TIPS,
GAS SELF-LIGHTING BURNERS,
BY-PASSES,
GAS FITTINGS,
METER COCKS,
SERVICE COCKS,
WAX TAPERS,
GOOSE NECKS,
SOCKETS, ETC.
TUBING,
IRON CASTINGS.

FOUNDRY: Peekskill, N. Y.

OFFICE: 1131-1133 Broadway, New York.

FACTORY: 447 to 453 W. 14th St.

Cyanogen.

A PURIFYING MATERIAL FOR GAS.

Soft and porous, it can be used in the natural state without any preparation, and it ensures perfect purification.

SPECIMENS AND PRICES ON APPLICATION.

VAN BAARDA & CO.,

MINE OWNERS,

DUSSELDORF-ON-THE-RHINE.

Special Trays for Iron Sponge or Oxide of Iron,

CHURCH'S TRAYS a Specialty.

Reversible, Strongest, Most Durable, Most Easily Repaired.

553-557 West Thirty-third Street, New York.

We also make the Cheapest and Strongest REVERSIBLE BOLTED TRAYS IN THE MARKET.

Send for Circulars.

Bristol's Recording

PRESSURE GAUGE.

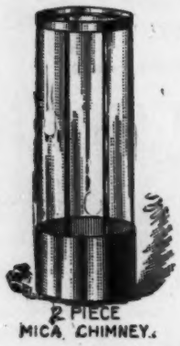
For continuous records of **Street Gas Pressure.** Simple in construction, accurate in operation, and low in price.

Fully Guaranteed. Send for Circulars.

THE BRISTOL CO.,

Waterbury, Conn.

Our Mica Chimneys



Etched Chimneys to Order.

For Welsbach Lights

ARE THE

BEST IN THE WORLD.

Get Catalog and Discounts.

The MICA MFG. CO.

Micasmiths,

88 Fulton Street, N. Y. City.

CHAPMAN VALVE MANUFACTURING CO.

MANUFACTURERS OF

Valves and Gates for Gas, Ammonia, Water, Etc.

Also, Gate Fire Hydrants with and without Independent Nozzle Valve. All Work Guaranteed.

Works & Gen'l Office, Indian Orchard, Mass. Treasurer's Office, 72 Kilby & 112 Milk Sts., Boston, Mass.
Chicago Office, 24 West Lake St. New York Office, 28 Platt St.
St. Louis Office, L. M. Rumsey Mfg. Co., 810 North Second St.

GASHOLDER TANKS AND GAS WORKS MASONRY COMPLETE

Plans prepared and Estimates furnished at short notice.

J. P. WHITTIER,

70 Rush St., Near Division Ave., Brooklyn, N. Y.

THE

Ludlow Valve Mfg. Co.,

TROY, N. Y., U. S. A.

Double and Single Gate Valves, ¼" to 72",

—FOR—

Gas, Water, Steam, Oil, Ammonia, Etc.

HOT GAS VALVES A SPECIALTY.

Send for Catalogue.

STEEL ROOFS

THE BERLIN IRON BRIDGE COMPANY.

Office and Works: EAST BERLIN, CONN.

STEEL BRIDGES

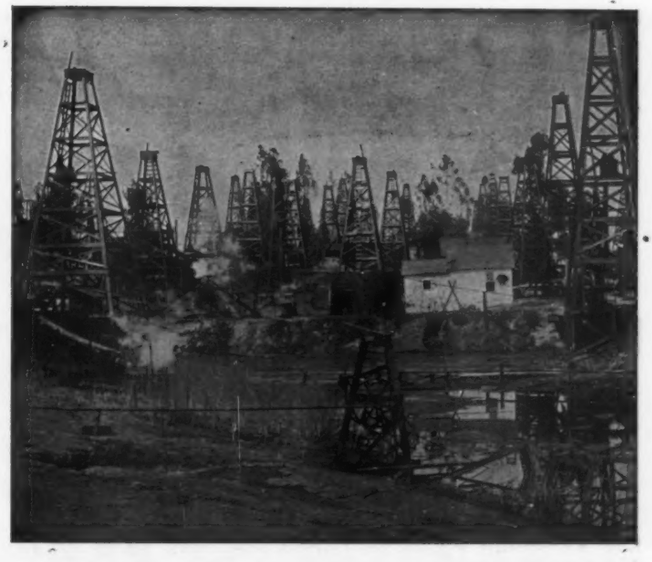
Gas Investments in California.

Nowhere else on this continent does such opportunity exist for profitable gas investment as on the Pacific Coast, since the perfection of the new LOWE Process for using the heavy crude California oils (of which there is an unlimited supply) without the use of any other fuels. Seven years' test proves the system to be perfect in every respect. Los Angeles alone, in addition to present street mains, has 150 miles of well built up streets without a gas main on them. To occupy this territory, and a large number of other towns now without gas, we have organized a parent company and a number of local companies covering some of the fastest growing cities in the United States.

Now is the time to invest, when the first capital will be able to double itself in a single year. This is also the most delightful residence section in the United States.

We suggest to those desiring gas investments, in large or moderate amounts—with or without active business connections—to come here and investigate; or, what is the next best thing, write us for particulars and prospectus.

The accompanying cut shows the oil wells in the suburbs of Los Angeles from which the Companies under the NEW LOWE GAS PROCESS obtain their supply of oil.



AMERICAN GAS & COKE CO. (T. S. C. Lowe, Manager),

406 Bradbury Building, Los Angeles, California.

THE GAS ENGINEER'S POCKET-BOOK.

By HENRY O'CONNOR.

Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works.

Price, - - $3.50.

A. M. CALLENDER & COMPANY, No. 32 Pine Street, N. Y. City.

AMERICAN GAS COMPANY

Constructors of Coal Gas Apparatus.

KLONNE-BREDEL

Recuperative Furnaces, Washers, Condensers, Purifiers and Purifying Machines, Ammonia Plant, Coke Conveyers, Etc.

Complete Works Erected with Guaranteed Results.

EASTERN AGENTS FOR

FRED. BREDEL'S SYSTEM
COAL GAS PLANTS AND GAS APPARATUS.

P. H. & F. M. ROOTS CO.'S
Exhausters, Blowers, etc.

222 South Third Street, Philadelphia, Pa.

GEORGE G. RAMSDELL, General Manager. Correspondence Solicited

FRED. BREDEL, C.E.

Coal and Water Gas Plants.

OWN SYSTEM.

RECUPERATIVE FURNACES, WASHERS, CONDENSERS, PURIFIERS, PURIFYING MACHINES, COKE CONVEYERS, ETC.

SOLE UNITED STATES AGENT FOR
ARROL-FOULIS MECHANICAL CHARGING AND DRAWING MACHINES.

Gas Enriching Plants to Enrich Coal Gas up to 24 Candle Power, and Making a White, Bright, Non-smoking Gas.

GAS RETORTS AND SPECIAL BLOCKS AND FIREBRICK MANUFACTURED UNDER THE SUPERINTENDENCE OF MY OWN CHEMIST.

COMPLETE GAS WORKS

No. 118 Farwell Avenue, · Milwaukee, Wis.

Eastern Agents: AMERICAN GAS CO., Construction Department, 222 So. 3d St., Phila., Pa

ROOTS'

LATEST IMPROVED GAS EXHAUSTER

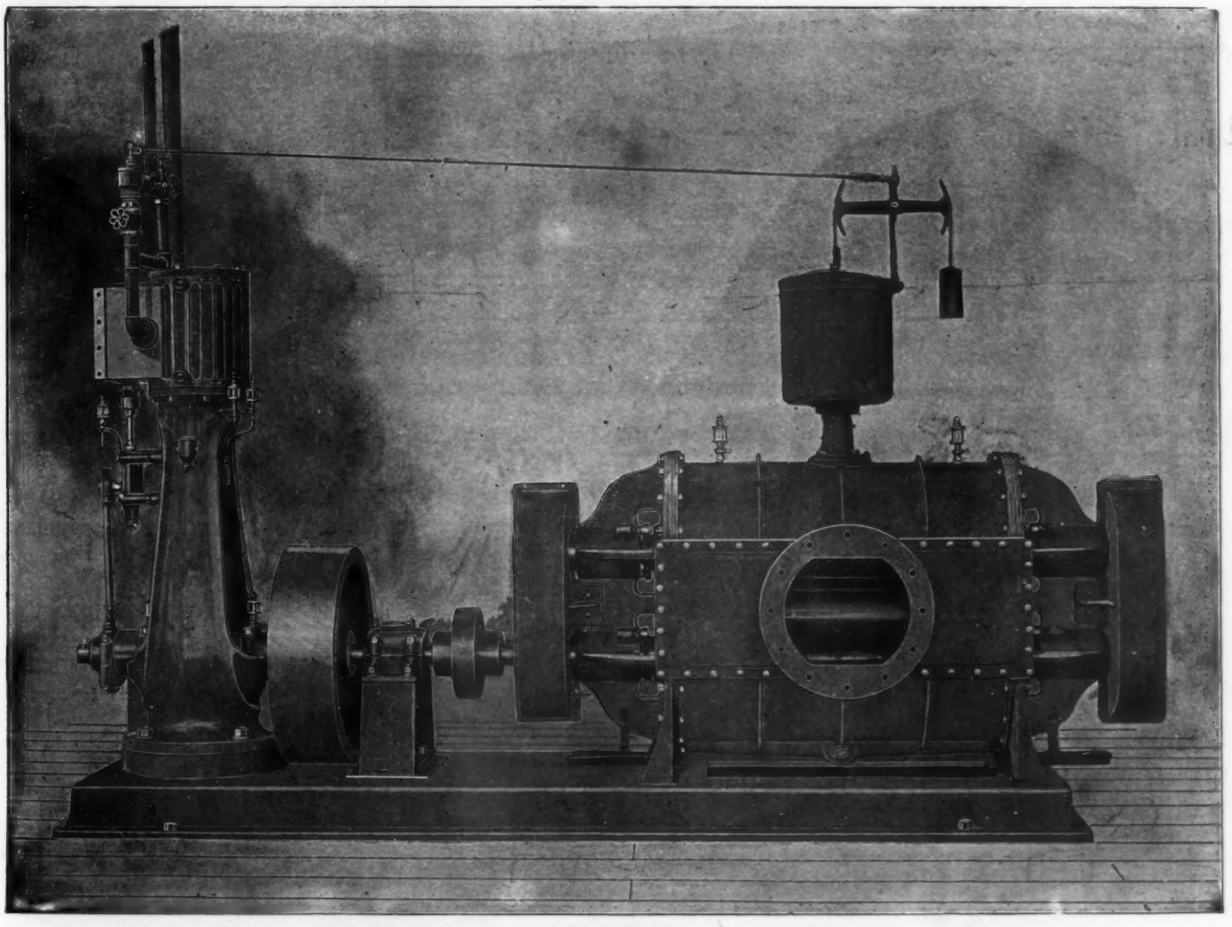
—AND—

NEW GAS GOVERNOR AND STEAM VALVE.

GUARANTEED TO REGULATE WITHIN ONE-TENTH OF AN INCH, WATER PRESSURE.

The Most Perfect Gas Governor on the Market.

MORE DIRECT IN ACTION. FEWER PARTS.
EASIER TO ADJUST THAN ANY OTHER GOVERNOR.



INQUIRIES CHEERFULLY ANSWERED. WRITE FOR CATALOGUE.

P. H. & F. M. ROOTS CO.,

Connersville, Ind. 109 Liberty St., New York.

Eastern Office:

American Gas Company,

222 South Third Street, Philadelphia, Pa.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY Prest. DAVID R. DALY V. Prest. & Treas.
H. D. ABERNETHY. Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES,
FIRE BRICK and FIRE CLAY SPECIALTIES

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

E. D. WHITE, President. A. H. GUTKES, Vice-President. H. A. PERKINS, Secretary.

Brooklyn Fire Brick Works,

MANUFACTURERS OF

CLAY RETORTS, FIRE BRICK,
Gas House and other Tile.

Office, 88 Van Dyke St. Brooklyn, N. Y.

Established 1854. Incorporated 1869.

LACLEDE
Fire Brick Manufg. Co.,

Manufacturers of { GAS RETORTS . .
FIRE BRICK . . .
RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

Exclusive Agents for

The Mitchell Half-Depth Regenerative Furnace.

This is the *original* coal-consuming Furnace for Retort Benches. Burns either Coal or Coke. Full and Half-Depth Regenerative Furnaces for Benches of 6's, 7's, 8's or 9's erected complete.

Proprietors of the Coze System of Inclined Retorts.

Office: 901 Pine St., **St. Louis, Mo.**

ESTABLISHED IN 1845.

B. KREISCHER & SONS,

Office, 119 E. 23d St., New York.

Gas Retorts,

TILES. FIRE BRICK.

AND EVERYTHING IN THE FIRE CLAY LINE.

Adam Weber,

Proprietor,

Manhattan Fire Brick and Enameled Clay Retort Works.

Works, Weber, N. J.

Office, 633 East 15th St., New York.

Modern Recuperative Furnaces

And Standard Fire Brick and Gas Retorts.

Works,
LOCKPORT STATION, PA.

—ESTABLISHED 1864.—

JAMES GARDNER, JR.,

Hamilton Building, Fifth Avenue
PITTSBURGH, PA. P. O. Box 373

Successor to WILLIAM GARDNER & SON

Fire Clay Goods for Gas Works.

SOLE REPRESENTATIVE OF THE McILHENNY REGENERATIVE BENCHES FOR THE U. S.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y.

Clay Gas Retorts,

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT

A Cement of great value for patching retorts, putting on mouth-pieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

PRICE LIST.

In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD & CO.,

N. 3d & Prospect Aves., Mt. Vernon, N.Y.

Western Agent, H. T. GEROULD, Centralia, Ills.

Parker-Russell Mining and Mfg. Co.,

CITY OFFICE,
417 Pine Street, St. Louis, Mo.

PROPRIETORS OF THE

OAKHILL GAS RETORT & FIRE BRICK W'KS

Our immense establishment is now employed almost entirely in the manufacture of

Materials for Gas Companies

We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. We construct

Half and Full Depth Benches of Our Own Design,

Containing 6, 8 or 9 Retorts.

We have Greatly Improved our Recuperators. Coal or Coke can be used as Fuel in Furnaces.

THEO. J. SMITH, Prest. J. A. TAYLOR, Sec'y
A. LAMBLA, Vice-Prest. and Supt.

BALTIMORE
RETORT & FIRE BRICK CO.

MANUFACTORY AT

LOCUST POINT BALTIMORE MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY,
AND FIRE CEMENT.

Red and Buff Ornamental Tiles and Chimney Tops. Baker Oven Tiles 12x12x2 and 10x10x2.

WALDO BROS., 102 MILK ST., BOSTON, MASS.

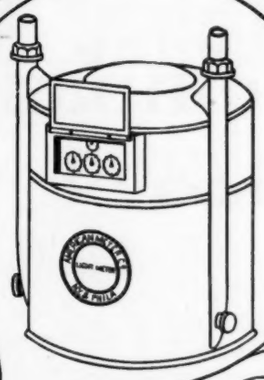
Sole Agents for New England States.

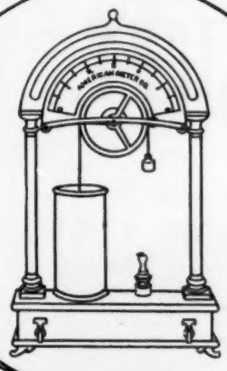
PRACTICAL PHOTOMETRY.

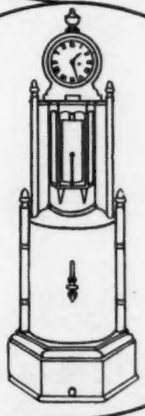
A Guide to the Study of the Measurement of Light.

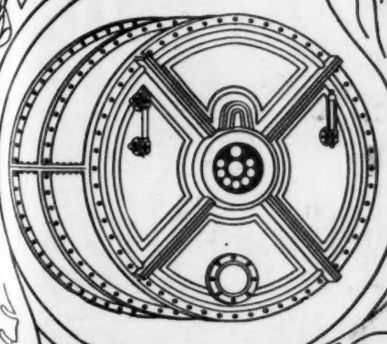
By WILLIAM JOSEPH DIBDIN.

With Numerous Illustrations. Price, $3.00 A. M. CALLENDER & CO., 32 Pine Street, N. Y. City









(Copyrighted, 1894, by the AMERICAN METER CO.

AMERICAN METER CO.

ESTABLISHED 1834. INCORPORATED 1863.

NEW YORK AND PHILADELPHIA,

CHICAGO, ST. LOUIS,

SAN FRANCISCO.

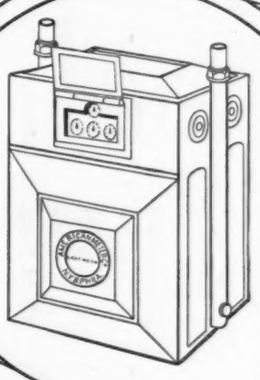
PUBLIC LIGHTING TABLE.

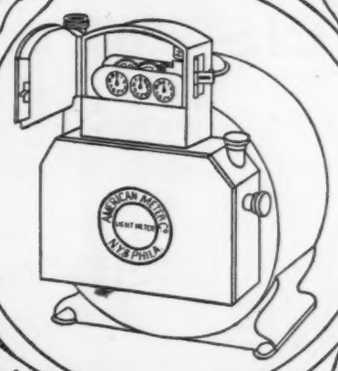
FEBRUARY, 1899.

Day of Week.	Table No. 1. Following the Moon. Date.	Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Wed.	1	5.50 PM	12.20 AM	5.05	6.15
Thu.	2	5.50	1.30	5.05	6.15
Fri.	3	5.50 LQ	2.40	5.05	6.15
Sat.	4	5.50	3.40	5.05	6.15
Sun.	5	6.00	4.50	5.10	6.10
Mon.	6	6.00	6.00	5.10	6.10
Tue.	7	6.00	6.00	5.10	6.10
Wed.	8	6.00	6.00	5.10	6.10
Thu.	9	6.00 NM	6.00	5.10	6.10
Fri.	10	6.00	6.00	5.10	6.10
Sat.	11	6.00	6.00	5.10	6.10
Sun.	12	6.00	5.50	5.20	5.55
Mon.	13	6.00	5.50	5.20	5.55
Tue.	14	10.00	5.50	5.20	5.55
Wed.	15	11.10	5.50	5.20	5.55
Thu.	16	12.10 AM FQ	5.50	5.20	5.55
Fri.	17	1.10	5.50	5.20	5.55
Sat.	18	2.00	5.50	5.20	5.55
Sun.	19	2.40	5.50	5.30	5.55
Mon.	20	3.20	5.50	5.30	5.55
Tue.	21	4.00	5.50	5.30	5.55
Wed.	22	4.30	5.50	5.30	5.55
Thu.	23	4.50	5.50	5.30	5.55
Fri.	24	No L.	No L.	5.30	5.55
Sat.	25	No L. FM	No L.	5.30	5.55
Sun.	26	No L.	No L.	5.30	5.45
Mon.	27	6.20 PM	9.10 PM	5.30	5.45
Tue.	28	6.20	10.20	5.30	5.45

TOTAL HOURS LIGHTING DURING 1899.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	215.40	January	423.20
February	184.40	February	355.25
March	187.40	March	355.35
April	166.50	April	298.50
May	158.00	May	264.50
June	140.50	June	234.25
July	150.30	July	243.45
August	168.30	August	280.25
September	179.50	September	321.15
October	213.20	October	374.30
November	217.00	November	401.40
December	238.10	December	433.45
Total, yr.	2221.00	Total, yr.	3987.45





Welsbach Commercial Company,

DREXEL BUILDING,

PHILADELPHIA.

WE NOW SELL

THE IMPROVED WELSBACH LIGHT

to all gas companies and first-class dealers in gas appliances.

SEND FOR NEW CATALOGUE AND PRICE LIST.

We are now prepared to furnish our New Combination Pilot Jet By-Pass and Adjustable Bunsen.

Our New Hot Wire Electric Igniter is a great improvement in electric gas lighting. Cannot short circuit. Send for prices and full information.

All imitations of the Welsbach light are infringements of the Welsbach patents, and the public is cautioned against purchasing such.

Suits brought by the Welsbach Light Company against manufacturers of infringing lights and mantles are still pending and undetermined.

Every genuine Welsbach lamp has the trade-mark, "Welsbach," conspicuously printed on the package and on the burner itself.

Welsbach Commercial Company,

DREXEL BUILDING,

PHILADELPHIA

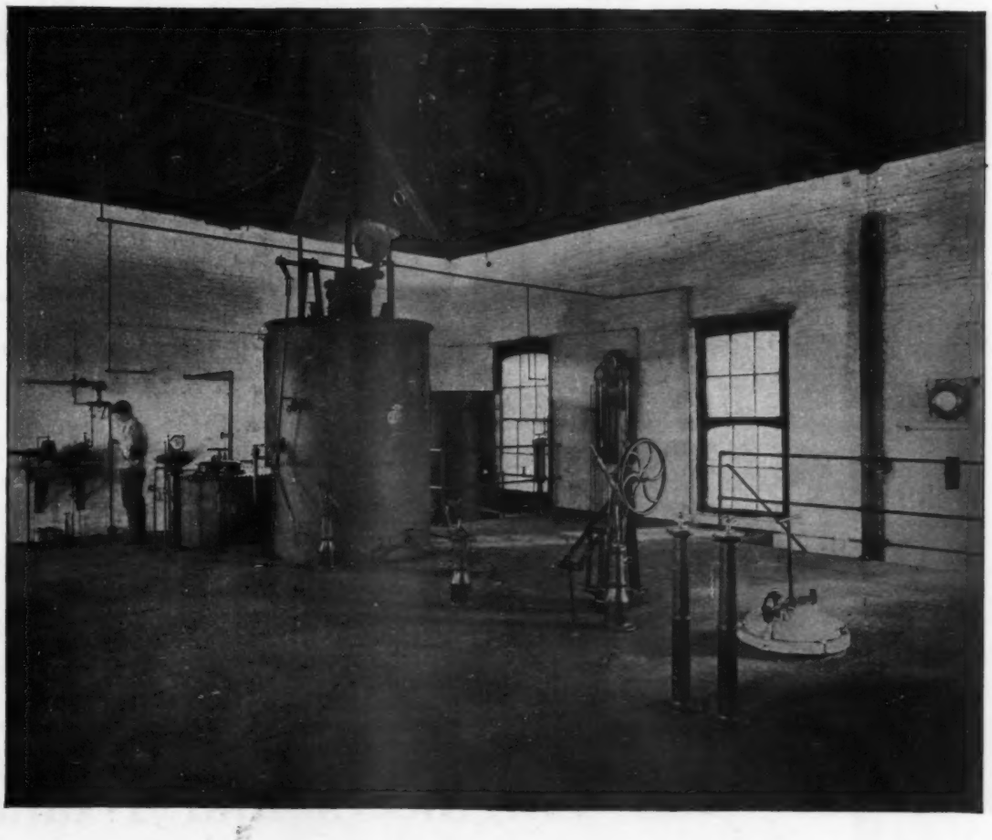
The United Gas Improvement Company,

DREXEL BUILDING, PHILA., PA.

The Standard Junior,

The Standard Double Superheater,

LOWE WATER GAS APPARATUS.



Total Built and under Construction,

294 Sets—Daily Capacity, 187,100,000 Cu. Ft.

NEW YORK, 33 NASSAU ST. PHILADELPHIA, 1932 MARKET ST. CHICAGO, 54 LAKE ST.

WELSBACH STREET LIGHTING COMPANY OF AMERICA,

—OWNS, CONTROLS AND OPERATES—
EXCLUSIVELY

THE NEW IMPROVED AND PATENTED STREET LIGHT BURNER.

STYLE No. 81.

Our PATENTED "STREET LIGHT APPLIANCES" have made WELSBACH STREET LIGHTING a complete success.

By the UNIFORM DISTRIBUTION of light on scientific principles a greater area can be lighted by our system and more economically than in any other way.

Where there are no gas mains already laid, we can furnish an equally good light by our **SELF-GENERATING NAPHTHA WELSBACH BURNER,** enabling Gas Companies to furnish a uniform light in all localities.

Lists of Cities and Towns in which we are now lighting under contract will be furnished upon application.

STYLE No. 97.

CORRESPONDENCE SOLICITED FROM GAS COMPANIES AND OTHERS INTERESTED IN MUNICIPAL LIGHTING.

PRACTICAL HANDBOOK ON

GAS ENGINES

With Instructions for Care and Working of the Same.

By G. LIECKFELD, C.E.

Translated with Permission of the author by GEO. M. RICHMOND, M.E.

Price, $1.00.

A. M. CALLENDER & CO., 32 Pine Street, New York.

NOW READY.

THE SIXTH (AND CENTENARY) EDITION
— OF THE —

Handbook for Gas Engineers and Managers.

By THOMAS NEWBIGGING, M. Inst. C.E.

This Edition of the "Handbook for Gas Engineers and Managers" is a great improvement on all previous editions. Much of the text has been re-written, in order to keep the work abreast of the constant advances that are being made in the Gas Industry.

PRICE, - - $6.00.

A. M. CALLENDER & CO., - - No. 32 Pine Street, N. Y. City.

National Gas and Water Company.

CONTRACTORS FOR
Gas Plant Machinery

SOFT COAL OR COKE
WATER GAS GENERATORS
A SPECIALTY.

218 LA SALLE ST.,
CHICAGO.

Gas Engineers
INSPECTION AND ADVICE.

PLANS AND ESTIMATES
FOR IMPROVEMENTS OR
REPAIRS.

CONNELLY IRON SPONGE AND GOVERNOR CO.,

(Successors to CONNELLY & CO.)
MANUFACTURERS OF GAS WORKS SPECIALTIES.

"IRON SPONGE." Saves money, saves labor, and is the most efficient purifying material ever offered as a substitute for lime. We guarantee a large saving, both in cost of material and labor.

AUTOMATIC GOVERNOR. OVER FOUR HUNDRED NOW IN USE! NO WORKS COMPLETE WITHOUT IT! WILL PAY FOR ITSELF WITHIN A YEAR! ITS SERVICE SECURES PERFECT DISTRIBUTION! REDUCES LEAKAGE TO MINIMUM, and BENEFITS THE COMPANY and CONSUMER ALIKE! IT IS THE ONLY RECOGNIZED AUTOMATIC GOVERNOR IN THE WORLD!

STEAM JET EXHAUSTER. Designed particularly for small works. Combines Exhaust Tube, Steam Governor, Gas Compensator and Bye-Pass Valves in the most compact form possible. Occupies but little space; uses very little steam; saves formation of carbon in retorts; increases yield 10 to 15 per cent. No works too small to use them profitably.

Prices given on all our specialties, delivered at any point in the United States. Correspondence solicited.

CONNELLY IRON SPONGE AND GOVERNOR CO., No. 357 Canal St., New York.

Hughes' "Gas Works,"

Their Construction and Arrangement,

And the Manufacture and Distribution of Coal Gas.

Originally written by SAM'L HUGHES, C.E.

Rewritten and Much Enlarged by
WM. RICHARDS, C.E

Eighth Edition, Revised, with Notices of Recent Improvements.

Price, $1.65.

A. M. CALLENDER & CO.,
32 Pine St., N. Y. City.

IRON MASS

For Gas Purification.

Acts immediately, and more efficiently than any other purifying agent now in use.

GREENPOINT CHEMICAL WORKS,
Greenpoint Ave. and Newtown Creek, Brooklyn, N. Y.

The Chemistry of Illuminating Gas.

By NORTON H. HUMPHRYS. Price, $2.40.
A. M. CALLENDER & CO., 32 PINE ST., N. Y. CITY.

ONEILL'S OXIDE,

(NATURAL BOG ORE)

For Gas Purification.

Has the Largest Annual Sale of Any Oxide in the World.

GAS PURIFICATION AND CHEMICAL CO., LTD.,
160, 161, 162 Palmerston Buildings,
Old Broad St., London, E. C., Eng.

Parson's Steam Blower,

FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREZEE OR OTHER WASTE MATERIAL.

PARSON'S TAR BURNER,

FOR USING COAL TAR AS FUEL.

PARSON'S AIR JET TUBE CLEANER,

FOR CLEANING BOILER TUBES.

These devices are all first-class. They will be sent to any responsible party *for trial*. No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY.

H. E. PARSON, Supt., 67 Bremen Street, Brooklyn, N. Y.

JAMES D. PERKINS, President. F. SEAVERNS, Treasurer.

THE PERKINS COMPANY,

228 and 229 Produce Exchange, New York City.

TIDEWATER SALES AGENTS FOR THE FOLLOWING:

Ocean Mine Youghiogheny Gas Coal,
Old Kentucky Shale and O. K. Boghead.

SHIPMENTS FROM NEW YORK, PHILADELPHIA, BALTIMORE AND NORFOLK.

BERWIND-WHITE COAL MINING COMPANY'S

Ocean Westmoreland Gas Coal.

Offices:
Washington Building, New York.
Betz Building, Philadelphia.

STRICTLY High Grade. . . . .
Carefully prepared.
For Gas Making or
Heavy Steaming.

SCIENTIFIC BOOKS.

NEWBIGGING'S HANDBOOK. By Thos. Newbigging. 6th edition. $6.

COX'S GAS FLOW COMPUTER. $2.50.

HUGHES' GAS WORKS. $1.25.

POOLE ON FUELS. By Herman Poole. $3.

GAS ENGINEER'S POCKET-BOOK. By Henry O'Connor. $3.50.

TECHNICAL GAS ANALYSIS. $3.

GAS CONSUMER'S HANDYBOOK, by Wm. Richards. 20 cents.

CHEMISTRY OF ILLUMINATING GAS. By Norton H. Humphrys. $2.40.

RACTICAL TREATISE ON HEAT By Thomas Box. 2d edition. $5.

PRACTICAL PHOTOMETRY: A Guide to the Study of the Measurement of Light. By W. J. Dibdin. $3.

CHEMICAL TECHNOLOGY: Vol. I., *Fuel and Its Applications*, $5. Vol. II., *Lighting*, $4.

IRONWORK: Practical Designing of Structural Ironwork. By H. Adams. $3.50.

GAS WORKS: Their Arrangement, Construction, Plant and Machinery. $5.

PRACTICAL HANDBOOK ON GAS ENGINES, by G. Lieckfield. $1.

LIQUID FUEL FOR MECHANICAL AND INDUSTRIAL PURPOSES. By E. A. Brayley Hodgetts. $2.50.

COAL: Its History and Use. By Prof. Thorpe. $3.50.

HE GAS WORKS OF LONDON. By Colburn. 60 cents.

HEAT A MODE OF MOTION. By John Tyndall. $2.50.

THEORY OF HEAT. By J. Clerk-Maxwell. $1.50.

MANUAL FOR GAS ENGINEERING STUDENTS. By D. Lee. 40 cents.

GASFITTER'S GUIDE, by John Eldridge 40 cents.

AMMONIA AND AMMONIUM COMPOUNDS. By Dr. R. Arnold. $2

CONSTRUCTION OF GAS WORKS, by Walter Ralph Herring. $2.

DIGEST OF GAS CASES. $5.

PRACTICAL HINTS ON REGENERATOR FURNACES By M. Graham. $1.25.

DISTILLATION OF COAL TAR AND AMMONIACAL LIQUOR. By Geo. Lunge. New edition. $12.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS. By D. A. Graham. $3.

A TEXT BOOK OF INORGANIC CHEMISTRY. By Prof. Victor Von Richter. $2.

ILLUMINATING AND HEATING GAS. By W. Burns. $1.50

HANDBOOK FOR MECHANICAL ENGINEERS. By H. Adams. $2.50.

TREATISE ON MASONRY CONSTRUCTION. Baker. $5

GAS ENGINEER'S LABORATORY HANDBOOK. By Jno. Hornby. $2.50.

GAS LIGHTING AND GAS FITTING. By W. P. Gerhard. 50 cents.

PRACTICAL PLUMBING. By P. J. Davies. $3.

AMERICAN PLUMBING. By Alfred Revill. $2.

CEMENT; A Manual of Lime and Cement, their Treatment and Use in Construction. By A. H. Heath. $2.50.

ELECTRICITY.

INDUSTRIAL PHOTOMETRY, with Special Application to Electric Lighting. By A. Palaz, Sc.D. $4.

ELEMENTS OF ELECTRIC LIGHTING, Including Electric Generation, Measurement, Storage and Distribution. By Philip Atkinson. $1.50.

ELECTRIC TRANSMISSION OF ENERGY. By G. Kapp. $3.50.

ELECTRICIAN'S POCKETBOOK. By Monroe and Jamieson. $2.50.

MAGNETISM AND ELECTRICITY. By J. Overend. 40 cts

DYNAMO BUILDING. By F. W. Walker. 50 cents.

DOMESTIC ELECTRICITY FOR AMATEURS. By E. Hospitalier. $2.50.

PRACTICAL MANAGEMENT OF DYNAMOS AND MOTORS. $1.

PRACTICAL GUIDE TO THE TESTING OF INSULATED WIRES AND CABLES. $1.

ELECTRIC LIGHTING, by Francis B. Crocker. $3.

ELECTRIC LIGHT FITTING. $2.

PRACTICAL ELECTRICITY. $2.50.

ELECTRICITY FOR ENGINEERS. $2.50.

ELECTRICITY, Its Theory, Sources and Applications. By John T. Sprague. $6.

The above will be forwarded upon receipt of price. If sent by mail or express, postage or express charges must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order. No books sent C.O.D.

A. M. CALLENDER & CO., 32 Pine Street, New York.

The Despard Gas Coal Co.,

MINERS AND SHIPPERS OF

DESPARD GAS COAL,

AND MANUFACTURERS OF

COKE.

MINES, - - Clarksburgh, Harrison Co., West Va.
WHARVES, - - - Locust Point Baltimore, Md.
OFFICE, - 640 Equitable Building Baltimore, Md.

ROUSSEL & HICKS, 71 Broadway, N. Y. } AGENTS, { BANGS & HORTON 60 Congress St., Boston.

KELLER ADJUSTABLE COKE CRUSHER.

Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER,
Sec. & Supt. Gas Lt. & Coke Co.,
Columbus, Ind.
Correspondence Solicited.

Do You Wish to Know

what size of pipe to use to convey any quantity of gas, any distance, with any loss of pressure and any initial or final pressure? Then use

Cox's Gas Flow Computer,

as it gives this information accurately at sight, without mental effort. No calculations needed. Saves time, money and mistakes.

Price, 6.5 x 8 inches, in cloth case, $2.50. For sale by

A. M. Callender & Co., 32 Pine St., N. Y.

GREENOUGH'S "DIGEST OF GAS CASES."

Price, $5.00.

This is a valuable and important work, a copy of which should be in the possession of every gas company in the country, whether large or small. As a book of reference it will be found invaluable. It is the only work of the kind which has ever been published in this country, and is most complete. Handsomely bound. Orders may be sent to

A. M. CALLENDER & CO., 32 Pine St., N. Y.

— THE —

PENN GAS COAL CO.

OFFER THEIR

Coal, Carefully Screened and Prepared for Gas Purposes.

Their property is located in the Youghiogheny Coal Basin, near Irwin and Penn Stations on the Pennsylvania Railroad, and on the Youghiogheny River.

Principal Office:

Room 720, Reading Terminal Building, Phila., Pa.

Points of Shipment:

Pennsylvania Railroad Piers; Greenwich Wharves, Delaware River: Pier No 1 (Lower Side), South Amboy, N. J.

EDMUND H. McCULLOUGH, Prest. CHAS. F. GODSHALL, Treas. H. C. ADAMS, Sec.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J., WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

THE SUN OIL CO.

Crude Oil, Gas Naphtha,
Refined Petroleum, Gas Oil.

Toledo, O., and Pittsburgh, Pa.

Standard Oil Company,

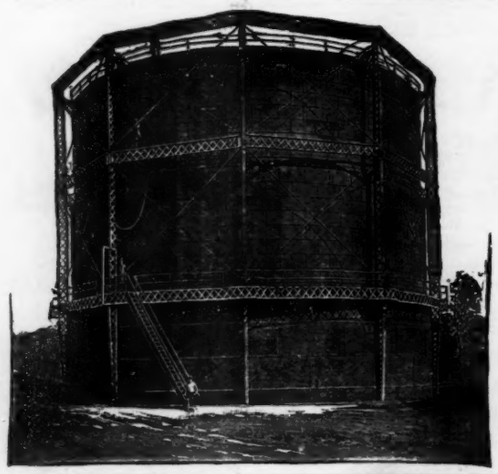
GAS NAPTHA DEPARTMENT.

GAS NAPTHA.

GAS OIL.

Correspondence Solicited.

26 Broadway, New York City.



DAVIS & FARNUM MFG. CO.,

WALTHAM, MASS.

Principal Office & Works, Waltham, Mass. Boston Office, R'm 18, Vulcan Bldg., 8 Oliver St.

Single, Double and Triple-Lift Gasholders of any Capacity. Tubular, Pipe and Sinuous Friction Condensers of all Sizes.

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

Self-Sealing and Pressed Steel Mouthpiece Lids.

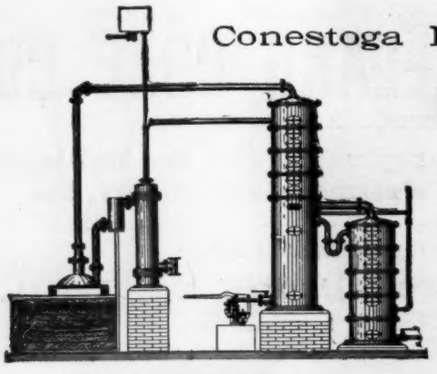
Coke Borrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Works.

Also, Gas and Water Pipe, Flanged Pipe, Sugar House Work, and Special Castings of all Descriptions.

GAS ENGINEERING COMPANY.

INCORPORATED,

Conestoga Building, PITTSBURGH, PA.



AMMONIA MACHINE.

MANUFACTURERS OF

Gas Works Machinery of all kinds,

PATENTEES AND OWNERS OF

PITTSBURGH WASHER-SCRUBBER,

SOLE AGENTS FOR

FELDMANN AMMONIA MACHINE,

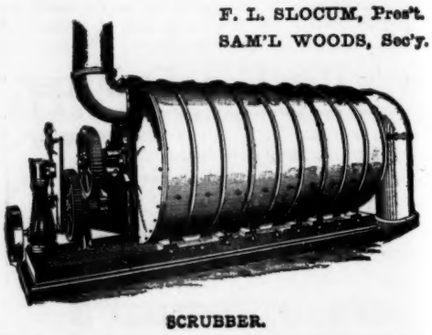
For producing Sulphate, Aqua, Chloride and Concentrated Liquors.

The Erection of Bi-Product Coke Ovens a Specialty.

Faux System of Recuperative Benches.

NEW SYSTEM HYDRAULICS.

F. L. SLOCUM, Pres't.
SAM'L WOODS, Sec'y.



SCRUBBER.

Kerr Murray Manufacturing Company,

Steel Gasholder Tanks,

SINGLE, DOUBLE AND TRIPLE-LIFT GASHOLDERS,

HORIZONTAL AND VERTICAL STORAGE OIL TANKS

Iron Work for Coal Gas Benches, Self-Sealing Mouthpieces, Exhausters, Condensers, Scrubbers, Purifiers, Wooden Trays, Floor Carriages, Center Seal and Valve System Connections, Cast and Wrought Iron Fittings, and Connections 3 to 36 Inches Diameter.

VALVES, Double Gate, Hub and Flange, Outside Screw and Quick Opening, 3 to 36 In. Diam.

COAL AND COKE WAGONS, RETORT HOUSE TOOLS, STREET MAIN SPECIALS AND DRIPS.

Address,

KERR MURRAY MANUFACTURING CO.

Fort Wayne, Indiana.

BARTLETT, HAYWARD & CO.

BALTIMORE, MD.

Triple, Double and Single-Lift Gasholders.

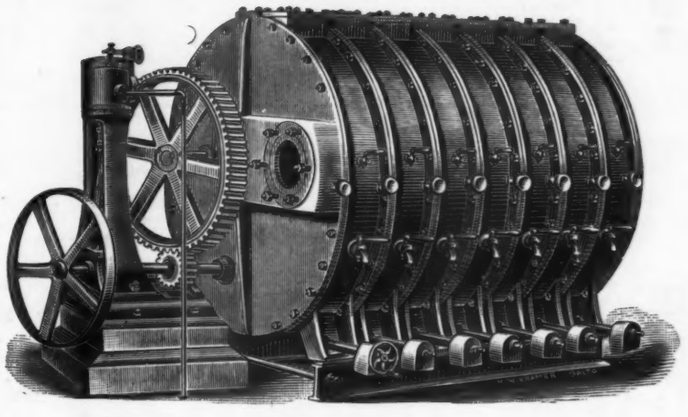
Iron Holder Tanks.

ROOF FRAMES.

Girders.

BEAMS

PURIFIERS.



CONDENSERS.

Scrubbers.

Bench Castings.

OIL STORAGE TANKS

Boilers.

PATENT STANDARD WASHER-SCRUBBER.

The best apparatus for the extraction of all Ammonia and a large proportion of Carbonic Acid and Sulphureted Hydrogen. The Scrubber has been materially improved and is provided with patented Wooden Segmental Grids, instead of Metallic Discs, thus reducing the weight on shaft and power for operating same.

The Wilkinson Water Gas Process.

THIRTY-CANDLE, NON-CONDENSIBLE, FIXED GAS. THE MOST SUCCESSFUL GAS PROCESS IN OPERATION.

MILL'S REVERSIBLE LIME TRAYS.

Gas Works Designed and Constructed.

POOLE ON FUELS.

THE CALORIFIC POWER OF FUELS.

WITH A VERY FULL COLLECTION OF TABLES OF HEATS OF COMBUSTION OF FUELS, SOLID LIQUID AND GASEOUS.

TO WHICH IS ALSO APPENDED

THE REPORT OF THE COMMITTEE ON BOILER TESTS OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS DECEMBER (1897); TABLES OF CONSTANTS USED.

By HERMAN POOLE, F.C.S.

FIRST EDITION.

Price $8. For Sale by

A. M. CALLENDER & CO. - - No. 32 Pine Street, New York City.

R. D. WOOD & CO.,

ENGINEERS. IRON FOUNDERS. MACHINISTS.

400 Chestnut Street, Philadelphia, Pa.

MANUFACTURERS OF

CAST IRON PIPE.

BUILDERS OF

Gas Holders,

Single, Double and Triple Lifts, with or without Wrought Iron or Steel Tanks.

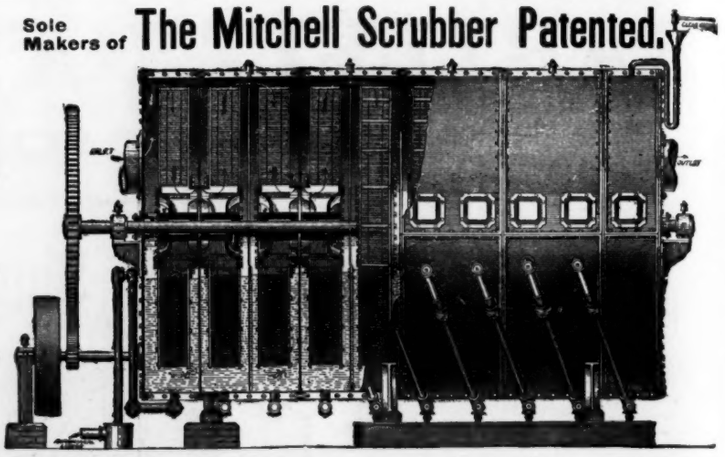
PURIFIERS, CONDENSERS, SCRUBBERS.

The Hopper Automatic Gas Governor

Send for Pamphlet.

Dunham Patent Specials.

Sole Makers of **The Mitchell Scrubber Patented.**



ISBELL-PORTER CO.,

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

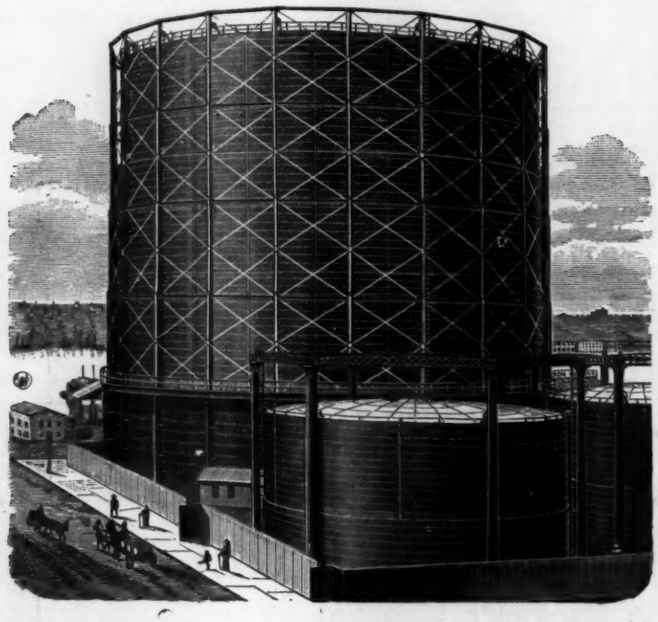
FOUNDERS AND MACHINISTS.

MANUFACTURERS OF

All Ironwork and Machinery Required in a Gas Plant.

Estimates, Drawings and Specifications furnished for the Alteration, Improvement, or Extension of Existing Works or the Construction of New Works.

245 Broadway, New York City. —OFFICES— **Bridge & Ogden Sts., Newark, N. J.**



The Continental Iron Works,

THOMAS F. ROWLAND, President.
WARREN R. HILL and CHAS. H. CORBETT, Vice-Presidents.
THOMAS F. ROWLAND, Jr., Secretary & Treasurer.

West and Calyer Sts. (Near 10th & 23d St. Ferries)
NEW YORK, Borough of Brooklyn.

BUILDERS OF

Gas Holders.

Single and Multiple Section Gas Holders a Specialty.

STEEL GAS HOLDER TANKS.

BENCH CASTINGS, RETORT LIDS.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, Etc.

Self-Sealing Retort Mouthpieces & Lids

For Round, Oval, or "D" Retorts.

ILLUMINATING GAS! FUEL GAS!

THE LOOMIS PROCESS.

Now in successful operation at Works of John Russell Cutlery Co., Turner's Falls, Mass., and Henry Disston's Son's Saw Works, Tacony, Pa.

The Cheapest Gas Generating System in the World.

Plans and Estimates Furnished.

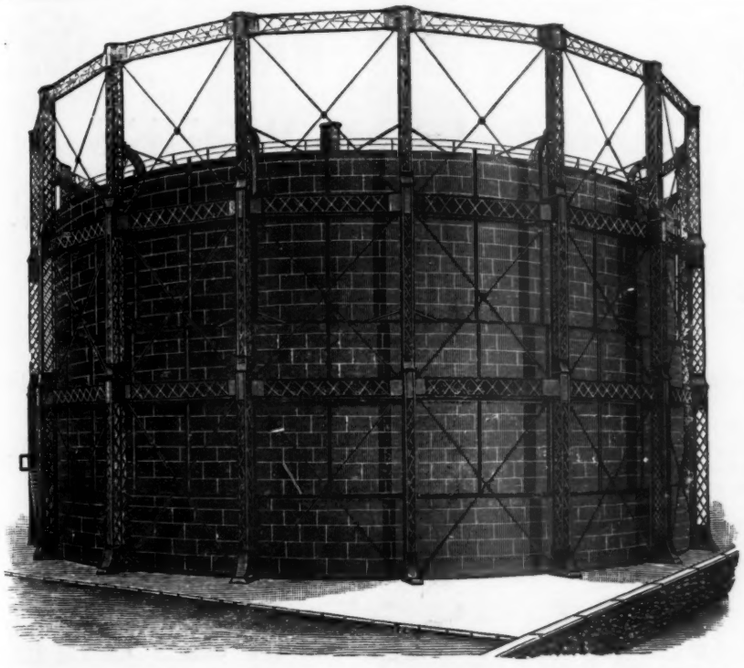
BURDETT LOOMIS, - - Hartford, Conn.

To Gas Companies.

We make to order **CAP BURNERS** to burn any amount under a stated pressure. Send for samples.

Also, SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

C. A. GEFRORER,
248 N. 8th St., Phila., Pa.



H. RANSHAW, Prest. & Mangr. T. H. BIRCH, Asst. Mangr
WILLIAM STACEY, Vice-Prest. R. J. TARVIN, Sec. & Treas.

THE STACEY MANUFACTURING CO

Established 1851.

Single, Double and Triple-Lift

GASHOLDERS,

Of any Capacity, with or without Wrought Iron or Steel Tanks.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, etc.

Coal Gas Benches, Roof Frames,

OIL STORAGE TANKS.

Pressed Steel Mouthpiece Lids, Self-Sealing Mouthpiece Lids.

Cincinnati, Ohio.

RITER-CONLEY MFG. CO.,

GASHOLDERS, with or without Steel Tanks.

Purifiers, Condensers, Scrubbers, Oil Tanks, Smoke Stacks.

STEEL ROOFS and BUILDINGS.

PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

GENERAL OFFICE: Pittsburg, Pa. EASTERN OFFICE: 39-41 Cortlandt St., New York City.

GEORGE R. ROWLAND.

Formerly with the Continental Iron Works.

Draughtsman and Constructing Engineer.

Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.

Office, No. 245 Broadway, N. Y. City.

W. H. PEARSON, Prest. J. W. WESTCOTT, Gen'l Mangr. and Treas. L. L. MERRIFIELD, Chief Engr.

THE ECONOMICAL GAS APPARATUS CONSTRUCTION COMPANY, Limited

269 Front Street, East, Toronto, Canada.

ENGINEERS AND BUILDERS OF THE **IMPROVED LOWE WATER GAS APPARATUS.**

Designed to give the Greatest Efficiency when using any kind of Oil, Anthracite Coal, Gas House or Oven Coke.

New Gas Works Built, Present Gas Plants, either Coal or Water, Remodeled

Catalogues, Plans and Estimates Furnished upon Application.

WM. HENRY WHITE,

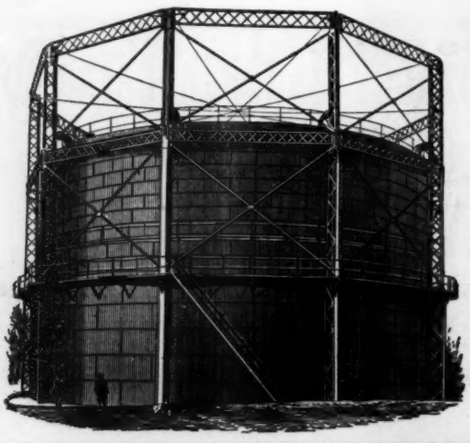
No. 32 Pine Street, - - - New York City.

ENGINEER AND CONTRACTOR FOR THE

ERECTION AND EXTENSION OF

GAS, WATER, AND ELECTRIC LIGHT WORKS.

Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited. Plans and Estimates Furnished.



1842 * Deily & Fowler, * 1899

LAUREL IRON WORKS.

Office, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

Gasholders

Single or Telescopic. With or Without Iron or Steel Tanks.

OIL TANKS. WATER TANKS, AND GENERAL WROUGHT IRON WORK.

JAMES R. FLOYD'S SONS,

Successors to HERRING & FLOYD,

Oregon Iron Works,

West 20th and 21st Streets, Between 10th & 11th Avenues, New York City.

Engineers and Contractors for the Construction of Gas Works.

MANUFACTURERS OF ALL KINDS OF CASTINGS AND GENERAL IRONWORK FOR GAS APPARATUS.

Bench Castings, Regenerative and Half Regenerative Furnace Castings, Condensers, Tower Scrubbers, Mechanical Scrubbers, Purifiers, Malleable Iron Retort Lids, Self-Sealing Retort Lids, Hydraulic Hoist Purifier Carriage, Crosses, Tees, Bends, Angles, Reducers, S-Bends, Sectional Sleeves, Plugs, Caps, Street Drips, etc., always on hand.

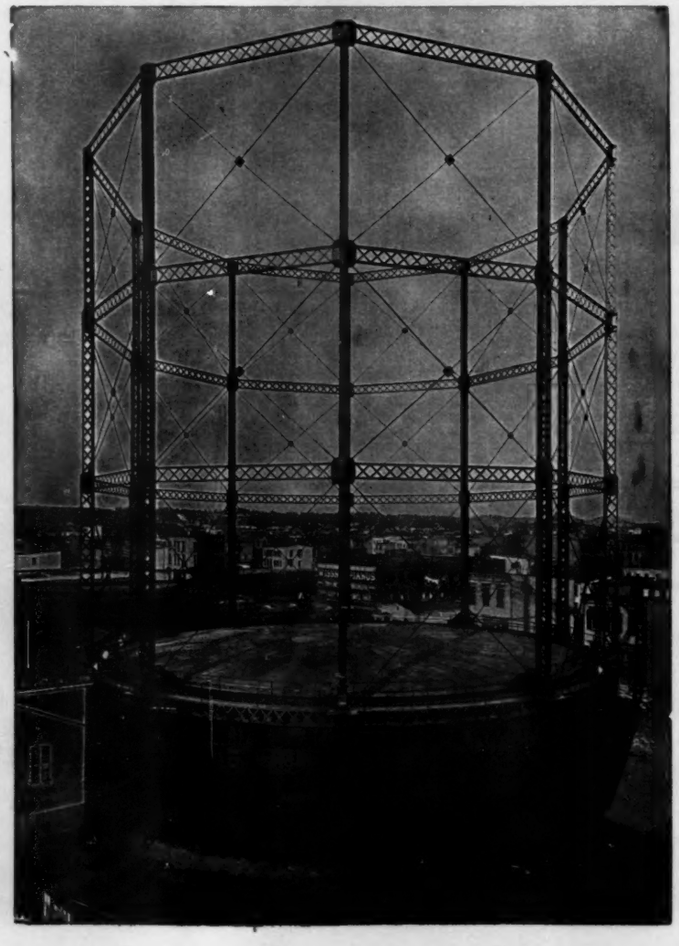
WOOD'S GAS SCRUBBING AND ENRICHING APPARATUS.

In use at Syracuse, Auburn, Watertown, Cortland and Geneva, N.Y.; Elizabeth, N. J.; Boston, Mass.; Jamaica Plain, Mass.; Providence, R. I.; Northern Liberties Gas Co., Phila.

Sole Manufacturers of the OGDEN QUICK-MOVING VALVE.

HEARNE CENTER SEAL, Operating One, Two, Three or Four Boxes.

Stroh & Osius Concentrator for Ammoniacal Liquor, used by 50 Gas Companies and Cokeries during the past 4 years.



The order for this Triple-Lift Holder and Steel Tank was received by the Logan Iron Works from the Union Gas Light Company, of East New York. The contract was completed and the Holder was in actual use in 90 days from receipt of order. Capacity of Holder, 500,000 Cu.Ft.

LOGAN IRON WORKS,

Brooklyn, N. Y.

MANUFACTURERS OF

Single or Multiple-Lift

GASHOLDERS,

Complete with Steel Tanks.

BENCHES, SCRUBBERS,

CONDENSERS,

PURIFIERS, IRON ROOFS,

Self-Sealing Retort Lids,

AND ALL PARTS OF

GAS WORKS APPARATUS.

Contractors for Complete Works.

ALSO, SOLE MANUFACTURERS OF

C. W. BLODGET'S

HOT GAS SCRUBBER.

THE OHIO PIPE COMPANY,

MANUFACTURERS OF

Cast Iron Gas & Water Pipe,

BRANCH AND SPECIAL CASTINGS.

Gas-House Bench Castings, Hydraulics, Lamp Posts, Flange Pipe and Specials, Architectural Castings, Building Columns, Joists, Cellar Grates, Sash Weights, etc.

GENERAL FOUNDERS AND MACHINISTS

Columbus, Ohio.

DAVID LEAVITT HOUGH,

26 CORTLANDT ST., N.Y. CITY.

Consulting Engineer.

Investigations and Appraisals.
Designs and Estimates.

Contractor.

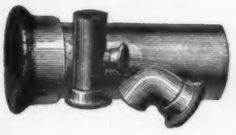
Machinery and Structures.
Gas and Water Pipe.

Special Agent for Selling & Purchasing.

WARREN FOUNDRY AND MACHINE CO.,

Established 1856. Works at Phillipsburgh, N. J.

New York Office, 160 Broadway.



CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches. Bends, Retorts, etc., etc

---

"GLOBE" SPECIALS, VALVES, ETC. "GLAMORGAN" FIRE HYDRANT

M. J. DRUMMOND & CO.

MANUFACTURERS OF

CAST IRON

FLANGE

GAS AND WATER PIPE

GENERAL SALES OFFICE, 192 BROADWAY, NEW YORK.

Western Office: Monadnock Block, Chicago, Ills.

GEORGE ORMROD, Mangr. & Treas., Emaus, Pa.
JOHN DONALDSON, Prest., Betz Bldg., Phila., Pa

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA

MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

Practical Hints

ON THE CONSTRUCTION AND WORKING OF

Regenerator Furnaces,

By MAURICE GRAHAM, C.E.

Price $1.25.

A. M. CALLENDER & CO., 32 Pine Street, N.Y.

CHARLES MILLAR & SON, Selling Agents, Utica, N. Y.

Flanged Pipe and Fittings, Hydrants, Gates, Pig Lead, Jute, etc.

UTICA PIPE FOUNDRY CO.

Manufacturers of Lead Pipe, Solder, etc., and Jobbers of Plumbers' and Tinners' Goods.

CAST IRON PIPE and SPECIALS FOR WATER AND GAS.

Wholesale Eastern Agents AKRON VITRIFIED SEWER PIPE.

Established 1854.

D. McDONALD & CO.,

MANUFACTURERS OF

WET AND DRY METERS, STATION METERS AND METER PROVERS.

— ALSO MAKERS OF

THE GLOVER PREPAYMENT METER.

The amount of gas delivered for the coin can be instantly and positively changed without removing the meter or replacing any parts.

The gas registered agrees absolutely with the amount purchased by the coin.

WE HAVE MADE AND SOLD IN THE UNITED STATES

OVER 30,000 OF THESE METERS,

ALL OF WHICH ARE GIVING PERFECT SATISFACTION.

Correspondence Solicited.

511 West Twenty-first Street, NEW YORK. | **51, 53 & 55 Lancaster Street, ALBANY, N. Y.** | **34 & 36 West Monroe Street, CHICAGO.**

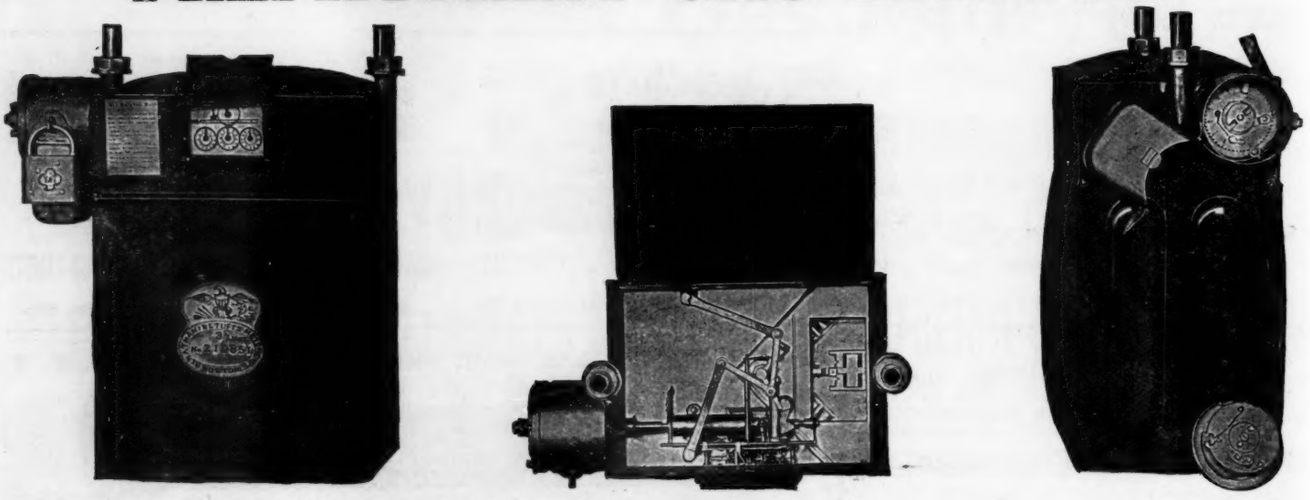
NATHANIEL TUFTS METER CO.,

Established 1849. 8 MEDFORD ST., BOSTON, MASS.

MANUFACTURERS OF

Dry Gas Meters, Station Meters, Test and Experimental Meters, Meter Provers, Photometers, Pressure Registers, Pressure Gauges, Etc.

PREPAYMENT GAS METERS.



SLIDE SHUT-OFF VALVE ON OUTLET OF METER.

ADJUSTABLE CHANGE PLATE FOR GAS FROM 75c. to $3 per 1,000.

THE EQUAL OF GAS RANGES FOR INCREASING CONSUMERS AND GAS SALES.

CHARLES E. DICKEY. JAMES B. SMALLWOOD. CHARLES H. DICKEY.

THE MARYLAND METER AND MANUFACTURING CO.

Established 1866.

BALTIMORE, North & Saratoga Sts. **CHICAGO, 107 West Monroe St.**
NEW YORK, 1131 and 1133 Broadway. **SAN FRANCISCO, 221 Front St.**

CONSUMERS' & STATION METERS, PRESSURE GAUGES, Etc., Etc.

"Perfect" Gas Stoves

THE DIFFERENCE BETWEEN GOOD METERS AND THOSE WHICH ARE "PRETTY GOOD" OFTEN MEANS THOUSANDS OF DOLLARS TO A SINGLE COMPANY.

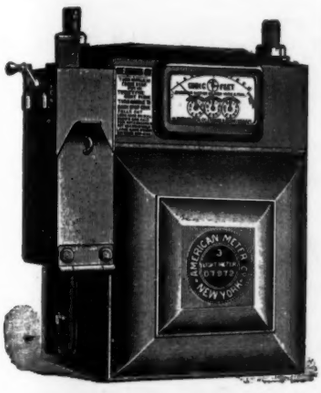
MANUFACTURE PERFECT GAS METERS

THE KEYSTONE METER CO.

GUARANTEE THEIR WORK TO GIVE SATISFACTION.

Full Line of Sizes Kept Constantly for Sale on the Pacific Coast with
WIESTER & CO., Agents,
17 & 19 New Montgomery St., San Francisco, Cal.

OFFICE AND FACTORY, ROYERSFORD, PA.



American Meter Co.

NEW YORK, PHILADELPHIA,
SAN FRANCISCO.

Prepayment Meters.

Their construction is such that they may be readily readjusted when the scale of gas rates is changed.

HELME & McILHENNY,

Established 1848. **1339 to 1349 Cherry Street, Philadelphia, Pa.**

MANUFACTURERS OF

Wet and Dry Gas Meters, Station Meters, Provers, Gauges, Etc.

METERS REPAIRED

PREPAYMENT GAS METERS.

Our Own Patents. Strong. Simple. PROMPT ATTENTION. CORRESPONDENCE SOLICITED.

METRIC METAL COMPANY,

MAKERS OF

GAS METERS for NATURAL and ARTIFICIAL GAS.

Special Attention given to Repairing METERS of all Makes.

FACTORY AT ERIE, PA.

THEODORE D. BUHL, President. CHARLES H. JACOBS, Secretary-Treasurer.

Detroit Meter Company,

DETROIT, MICH.

Manufacturers of . .

GAS METERS of the HIGHEST QUALITY

METER REPAIRING A SPECIALTY. SEND FOR OUR PRICE LIST.

Detroit is one of the best shipping points in the United States for prompt deliveries by rail or water to the East, West or South.

BUHL Meters will need few Repairs. We make our own Tin Plate. Trial Orders Solicited.

The advertisement of

THE WESTERN GAS CONSTRUCTION COMPANY, Engineers and Builders,

Improved Double Superheater Lowe Water Gas Apparatus—Manufacturers of General Gas Works Machinery—Builders of Gas Works

WM. HENRY WHITE, Eastern Engineer, 32 Pine St., New York.

FORT WAYNE, IND.,

Occupies this space every alternate week

JOHN J. GRIFFIN & CO.,

1513-1515-1517-1519-1521 Race Street, Philadelphia.

52 Dey Street, New York.
WM. S. GRIBBEL, Manager.

75 N. Clinton St., Chicago.
FREDERICK WAUGH, Manager.

MANUFACTURERS OF

STATION METERS, CONSUMERS' METERS,

Provers, Registers, Gauges, Experimental Apparatus, Etc.

Prompt Attention Given to All Repairing.

OUR SPECIAL NATURAL GAS METER

Is the Best ever offered. Over 30,000 now in use.

We manufacture in the United States, under the **SAWER & PURVES PATENTS**, the

Positive Prepayment Meter.

. . SIMPLE . .

. DURABLE .

. ACCURATE .

. RELIABLE .

All Parts Interchangeable

This Meter is an unqualified success in Great Britain. Its simplicity of construction, and the positive character of the service performed by it, have given it pre-eminence.

Needs Only the Care Given an Ordinary Meter.
Saves MONEY, TIME and CONSUMERS.
Dispenses with "DEPOSITS" and Increases OUTPUT.